Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

OCTOBER, 1960

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Read and pass on—

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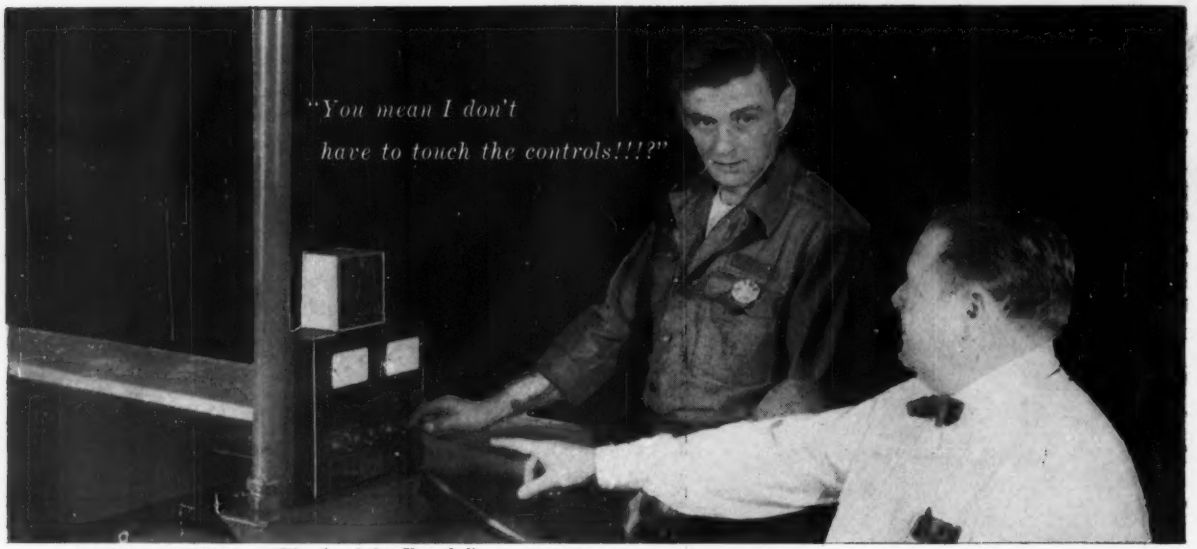
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HAROLD GURNEY: "That's right Frank."
"*This* unit is specially designed for anodizing. With this new RAPID rectifier, output current adjusts itself automatically to compensate for load changes."



Plating Foreman: "You mean I set it once and forget it?"

Harold Gurney: "Right again. You see, the unit continuously senses load variations and automatically maintains a constant current density per square foot of work."

Plating Foreman: "That makes it a lot easier to accurately control a pre-determined film thickness in anodizing."

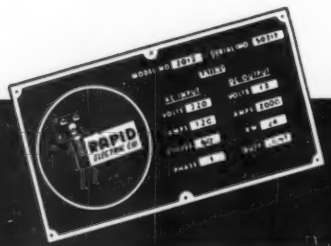


Harold Gurney: "You're catching on fast. And what's more, Automatic Current Density Control eliminates the possibility of overcurrent and subsequent costly rejects, maintaining Fenn's high quality standards."

Fenn Manufacturing Company, Newington, Connecticut

Take a tip from Harold Gurney. Find out how ACC can save you both time and money.

Write for Rectifier News Bulletin Vol. 2, No. 1 or ask to have a representative call. No obligation of course.

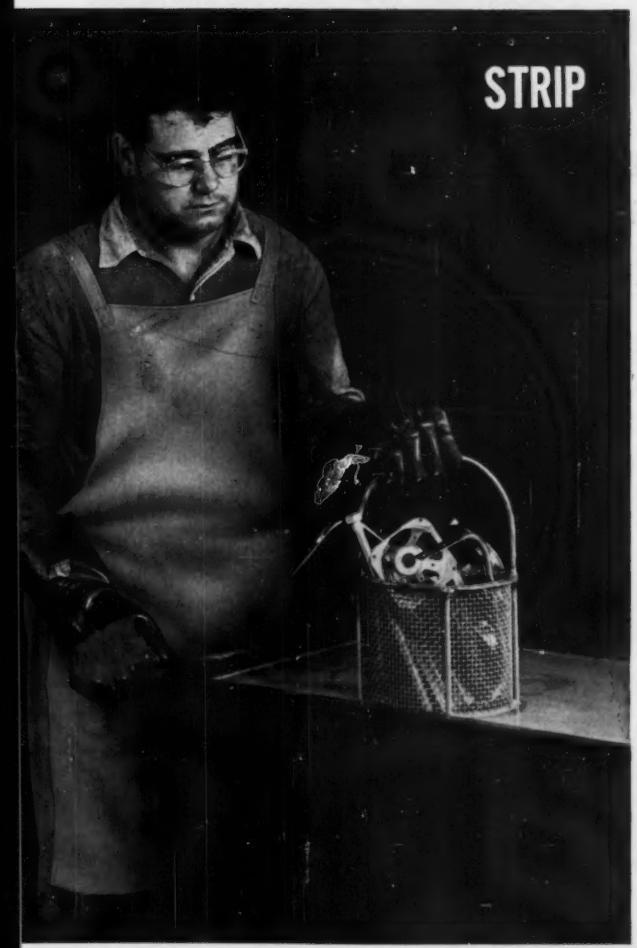


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Newly-developed Enstrip S-60 is a ready-to-use nickel stripper which costs only nickels, not dollars, per pound. And for this low price you also buy convenience, savings in labor. No electric current is required with Enstrip S-60. Just weigh it out, dissolve in water and start stripping nickel, copper, brass, zinc, cadmium or silver plate from steel, iron alloys, magnesium. The powdered alkaline compound, containing cyanide, dissolves faster than metal strippers to which cyanide eggs or bricks must be added.

S-60 can be used at room temperature and parts can be stripped overnight. Although work soaks for several hours after stripping is complete, there is no attack on most steel alloys.

For faster stripping, use the solution in the 70° - 170°F range, depending upon the metal being stripped. Brass and copper are removed at a rate of 0.0003″ per hour at 140° - 150°F and nickel coatings as rapidly as 0.002″ per hour at 140° - 170°F.

Write to Enthone, Inc., 442 Elm St., New Haven 8, Conn., for complete information about Enstrip S-60 ready-to-use nickel stripper.

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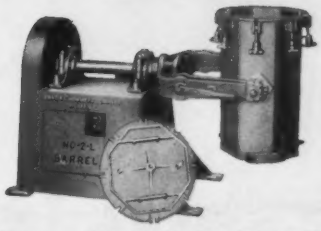
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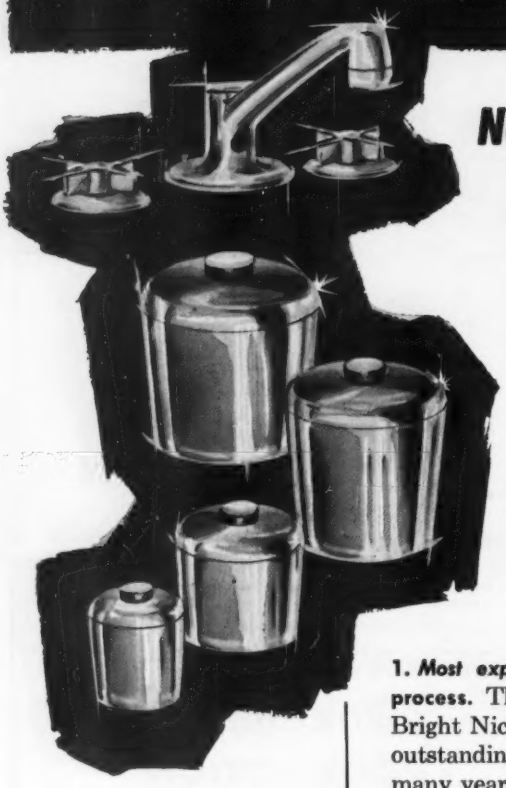
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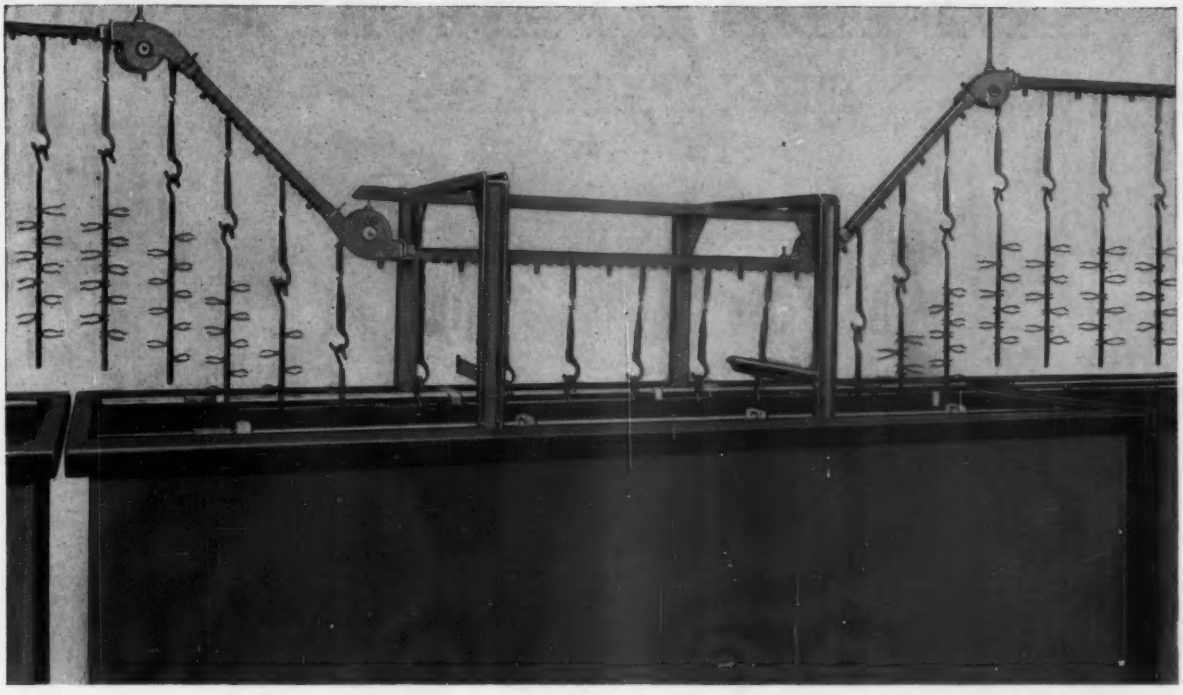
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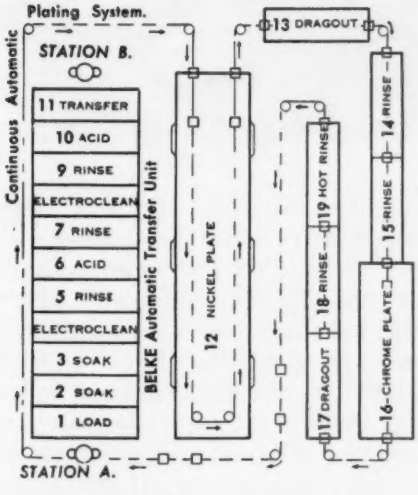
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Automatic Plating you **CAN** afford



Processing Cycle of above layout

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STATION B. 11, Transfer racked work to Continuous Automatic Plating System. 12, Nickel Plate. 13, Nickel Dragout. 14, Rinse. 15, Rinse. 16, Chrome Plate. 17, Chrome Dragout. 18, Rinse. 19, Hot Rinse.
STATION A. 20, Unload finished work.

"Automatic Plating at one-third the cost quoted for conventional full automatics to do the same work!" . . . that's what users of BELKE Continuous Automatic Plating Systems report.

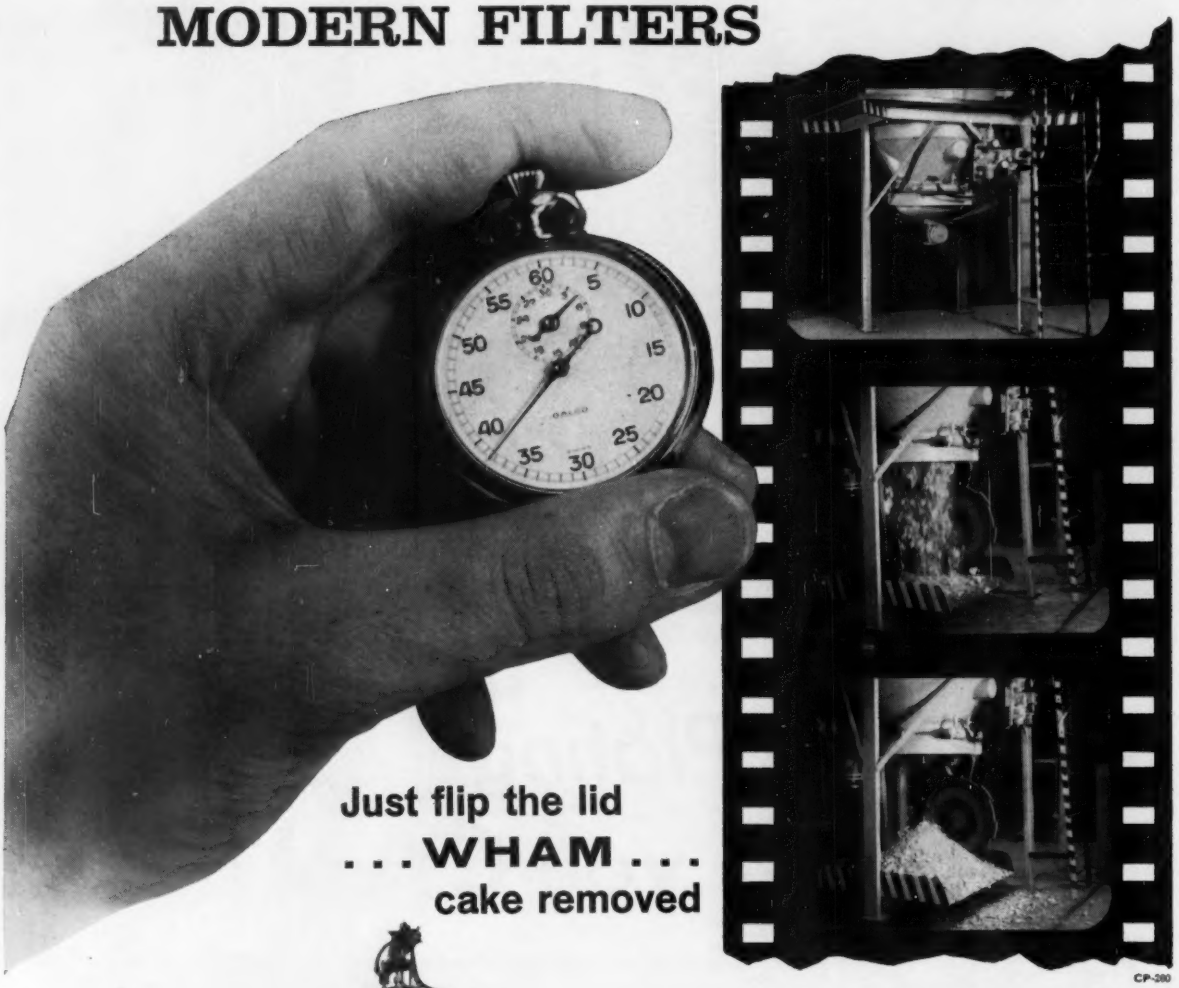
You can soon find out how much the BELKE Automatic System will save you and how much it will cost. Just tell us —

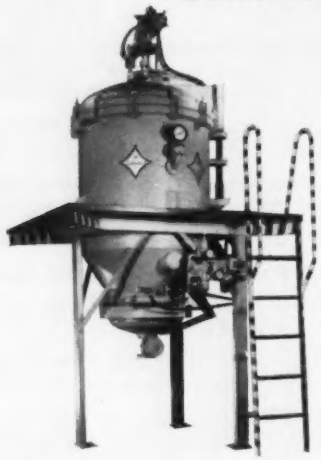
1. **Your complete cleaning, plating and after plating cycle — step by step — including the time in each bath.**
2. **The size, shape and number of pieces per rack.**
3. **The number of rack loads per day.**
4. **Send sketch, showing floor plan where equipment will need to be installed.**
5. **List of Power equipment, tanks, etc., you now have that you would like us to use in the BELKE Automatic System.**

When we get this information we will submit for your consideration a layout of suggested Automatic System with anticipated rate of production and approximate cost utilizing your present equipment wherever practical.

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SAVE TIME and EFFORT WITH MODERN FILTERS





These rapid cleaning devices on INDUSTRIAL filters offer tremendous advantages to the user through removal of, and subsequent disposing of waste materials or recovery of valuable solids.



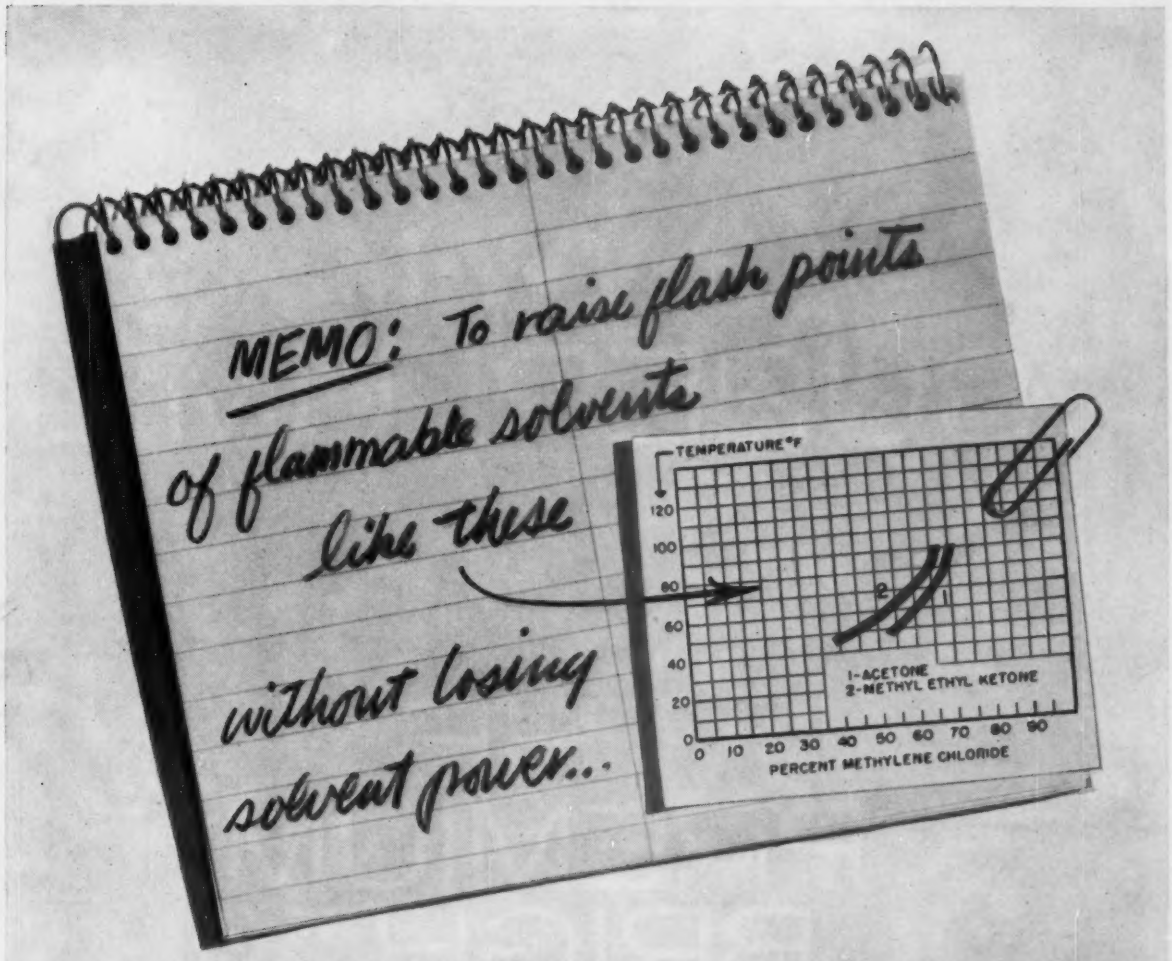
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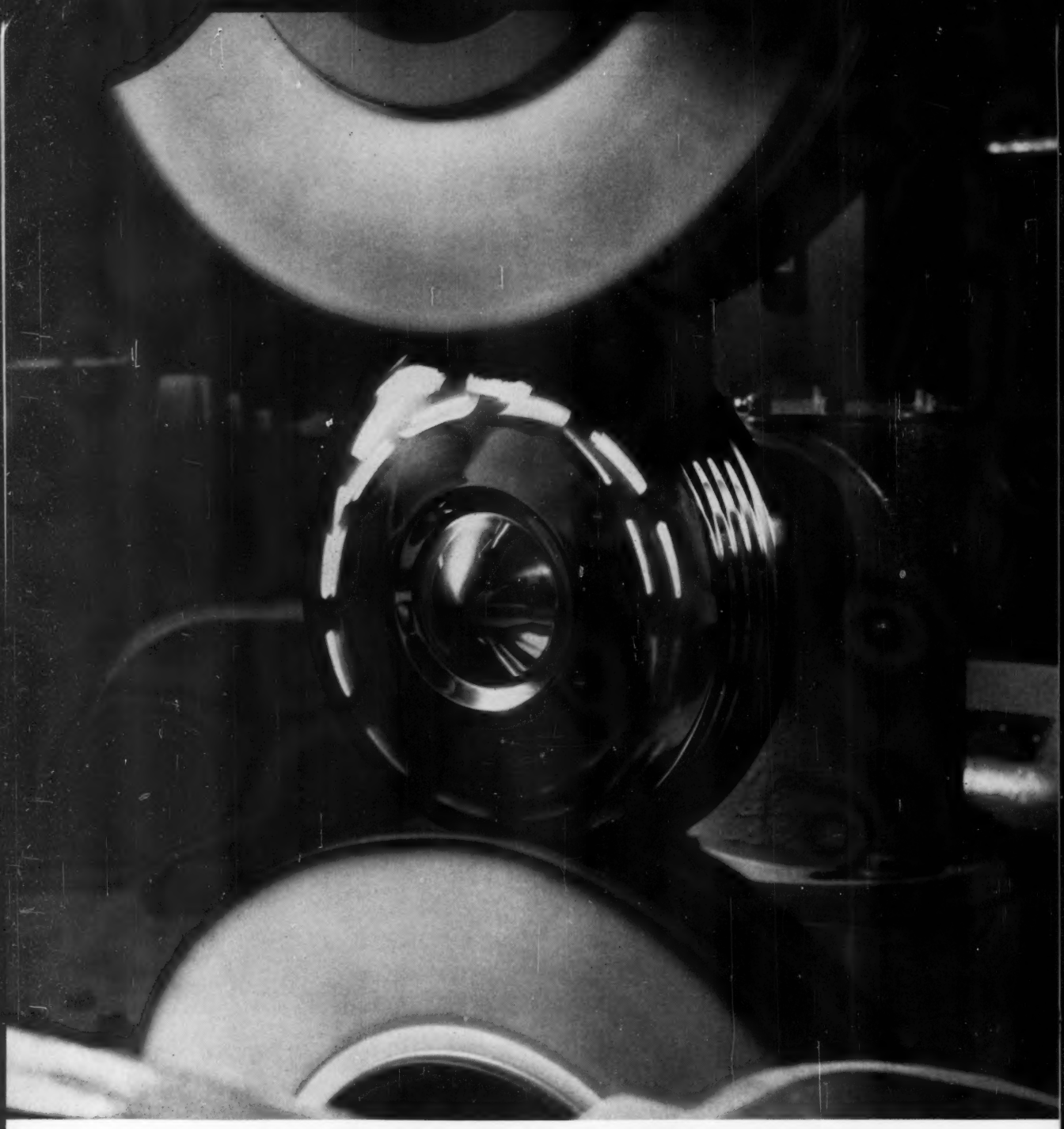
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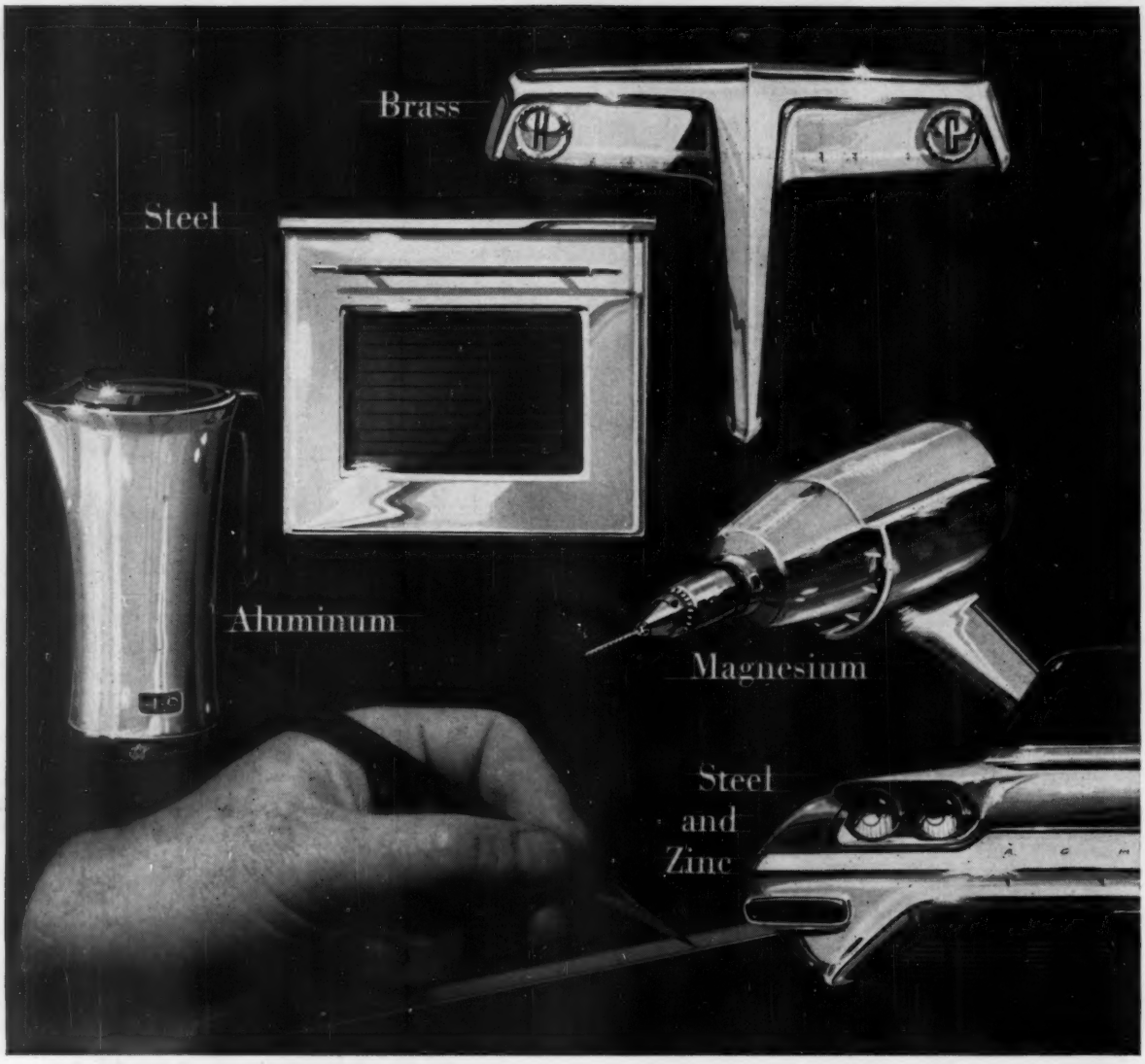
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- extrudability of aluminum
- lightness of magnesium
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Nickel makes plating perform better longer

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Machine Modifies Easily Quick removal or addition of tank-and-carrier sections shortens or lengthens machine to suit any need.

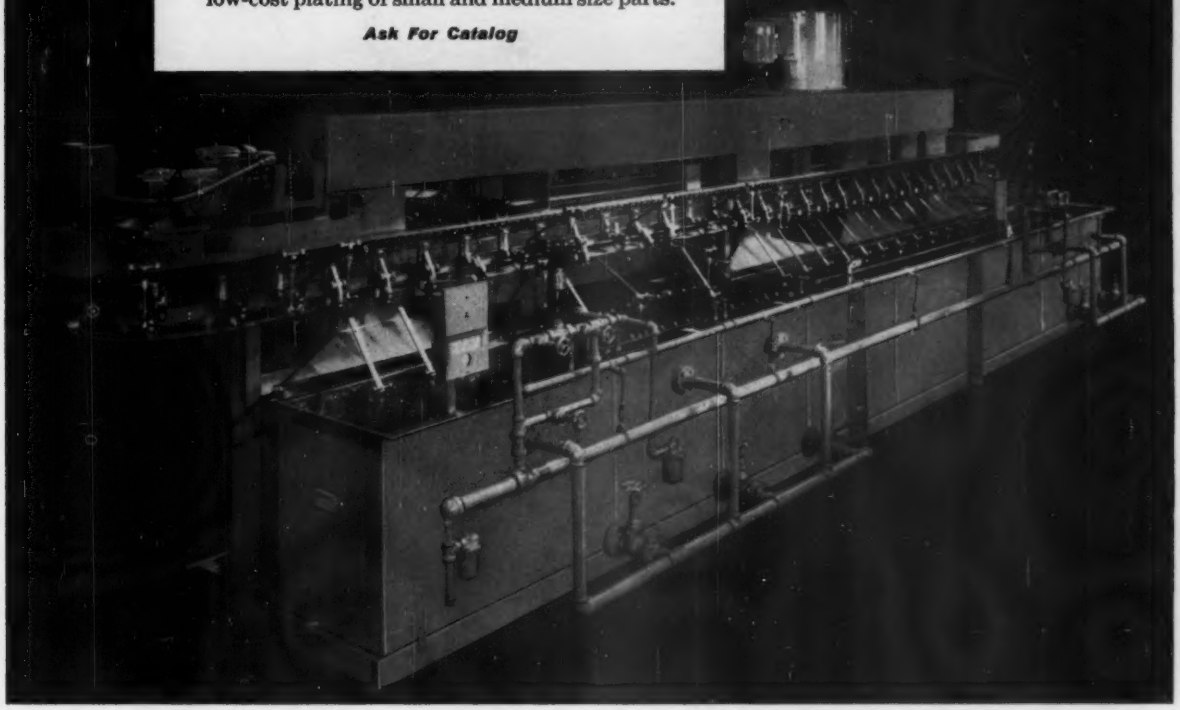
Installs Anywhere Daw Junior fits in any unusual or limited floor space, and where head-room is lowest.

Fast And Economical The most versatile, most efficient machine ever designed for fast, low-cost plating of small and medium size parts.

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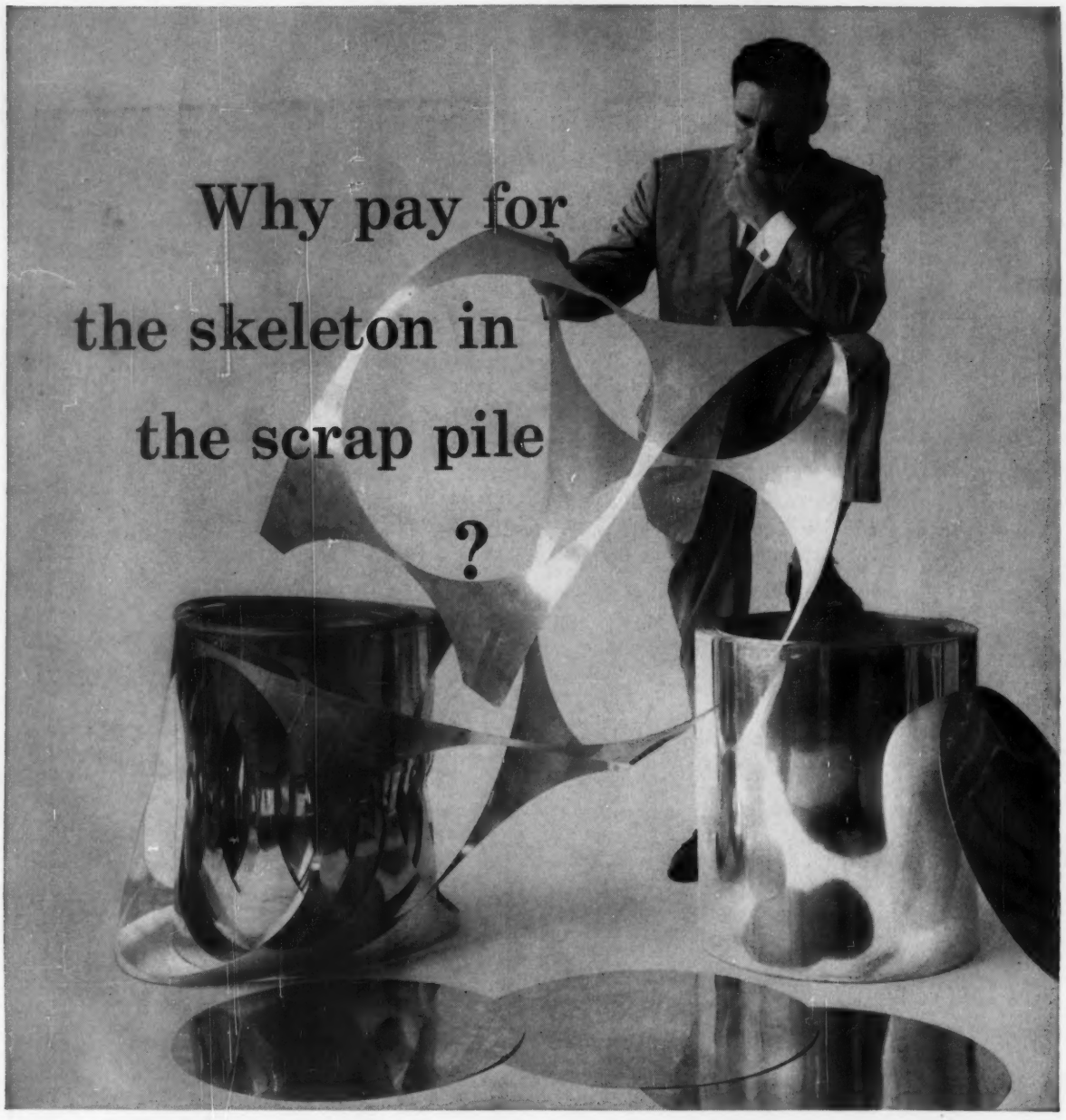
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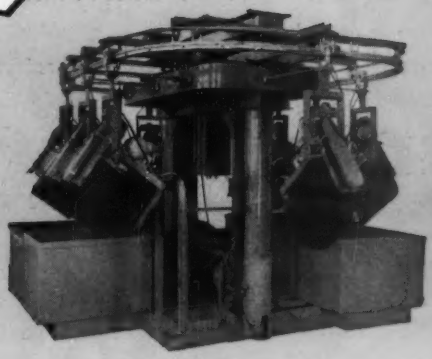
Other Fairmont benefits: the consistent quality that is a Fairmont tradition . . . individual flash annealing for finer grain structure . . . 100% inspection of every blank.

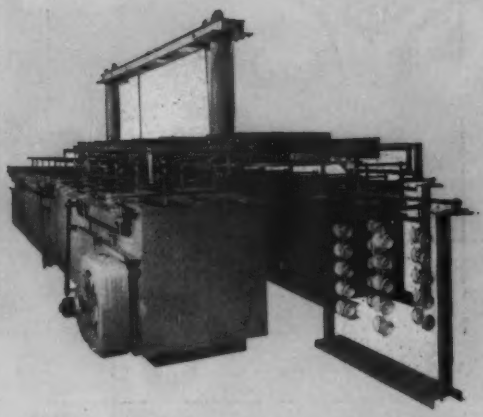
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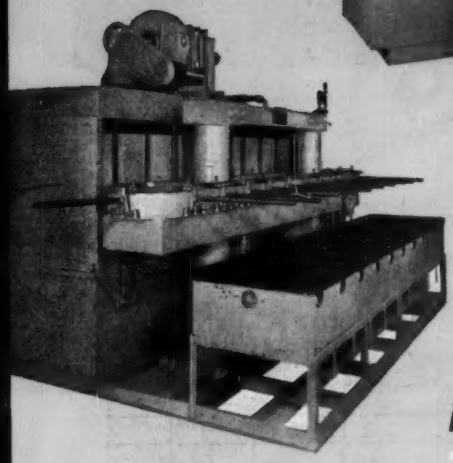
A Fairmont engineer will be glad to give you details. Call your local Fairmont office. Or write Vice President, Sales, Dept. 28-J, Fairmont Aluminum Co., Fairmont, West Va.

FAIRMONT ALUMINUM COMPANY | subsidiary of CERRO DE PASCO CORPORATION

CROWN AUTOMATICS



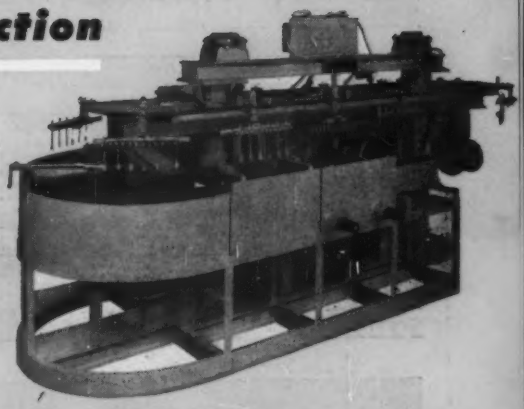


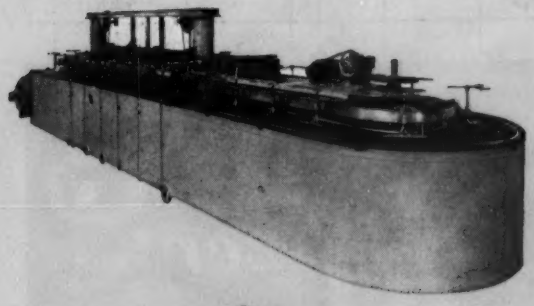


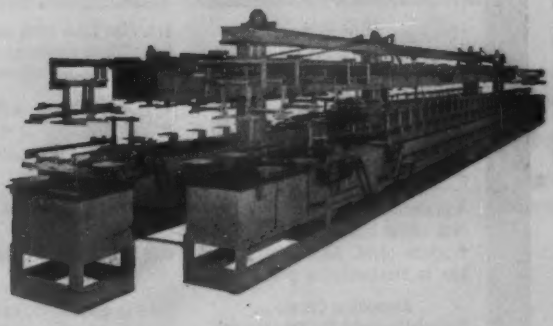
increase production

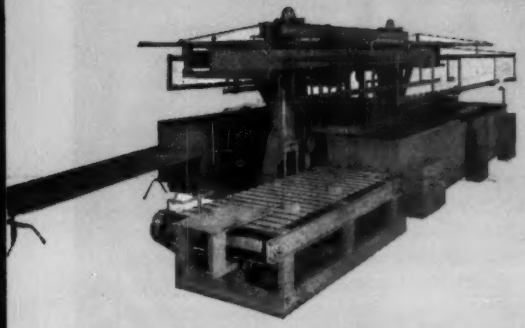
reduce costs

improve quality





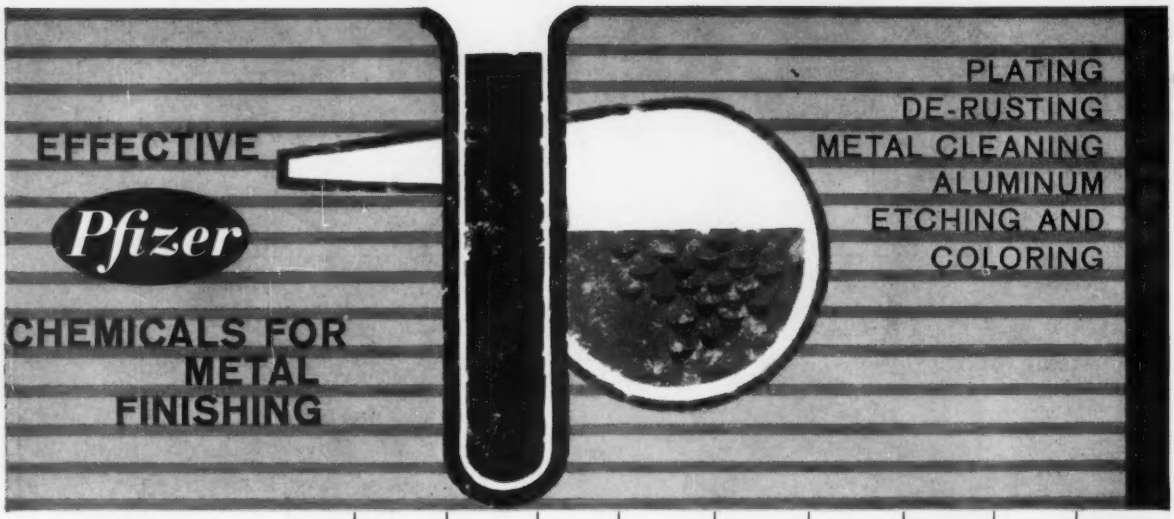




Crown Automatics are ideal for plating your barrel or racked work. Crown manufactures the widest variety of fully automatic plating machines in the industry... *there is a model to fit your needs.* Write us details of your job and production requirements.

CROWN RHEOSTAT AND SUPPLY COMPANY

1965 PRATT BOULEVARD • ELK GROVE VILLAGE ILLINOIS



	Cleaning	Polishing	Pickling	Electroplating	Electropolishing	Non-Electrolytic Depositions	Electrolytic Oxidation	Etching	Gold Coloring of Aluminum
Citric Acid	✓	✓	✓	✓	✓	✓	✓	✓	
Sodium Citrate	✓	✓		✓		✓			
Ammonium Citrate	✓	✓	✓	✓					
Gluconic Acid	✓	✓	✓	✓				✓	
Glucono Delta Lactone	✓	✓	✓	✓				✓	
Sodium Gluconate	✓	✓		✓				✓	
Oxalic Acid	✓	✓	✓	✓	✓		✓	✓	
Ammonium Oxalate	✓	✓		✓					
Ferric Ammonium Oxalate									✓
Tartaric Acid	✓		✓	✓				✓	
Tartar Emetic				✓					
Rochelle Salt			✓	✓					
Cream of Tartar	✓			✓					

Citric Acid...
Nontoxic, mild, yet chemically active against scale and tarnish. Used extensively in the formulation of general metal cleaners and polishes, particularly household products.

Sodium Citrate...
A preferred ingredient in electroless nickel baths, resulting in a brighter plate. Also finds wide use in electroplating processes.

Ammonium Citrate...
Especially useful for the removal of rust in near neutral solutions. Extremely mild and safe to handle.

Gluconic Acid...
An excellent sequesterant in alkaline derusting solutions; provides rust-free, clean surface ready for further treatment. Also highly effective in aluminum etching and paint stripping compounds.

Oxalic Acid...
The most effective chemical for use in automobile radiator cleaners. Also finds wide use in electropolishing and as an ingredient in general metal cleaners.

Ferric Ammonium Oxalate...
Used extensively in the production of light-fast gold colored aluminum.

Tartaric Acid...
Excellent complexing agent for copper in electroplating.

Tartar Emetic...
Used in electrolytic baths for deposition of silver and antimony alloys on brass, copper and steel surfaces.

Rochelle Salt...
Increases efficiency and yields finer-grain deposit in alkaline copper plating.

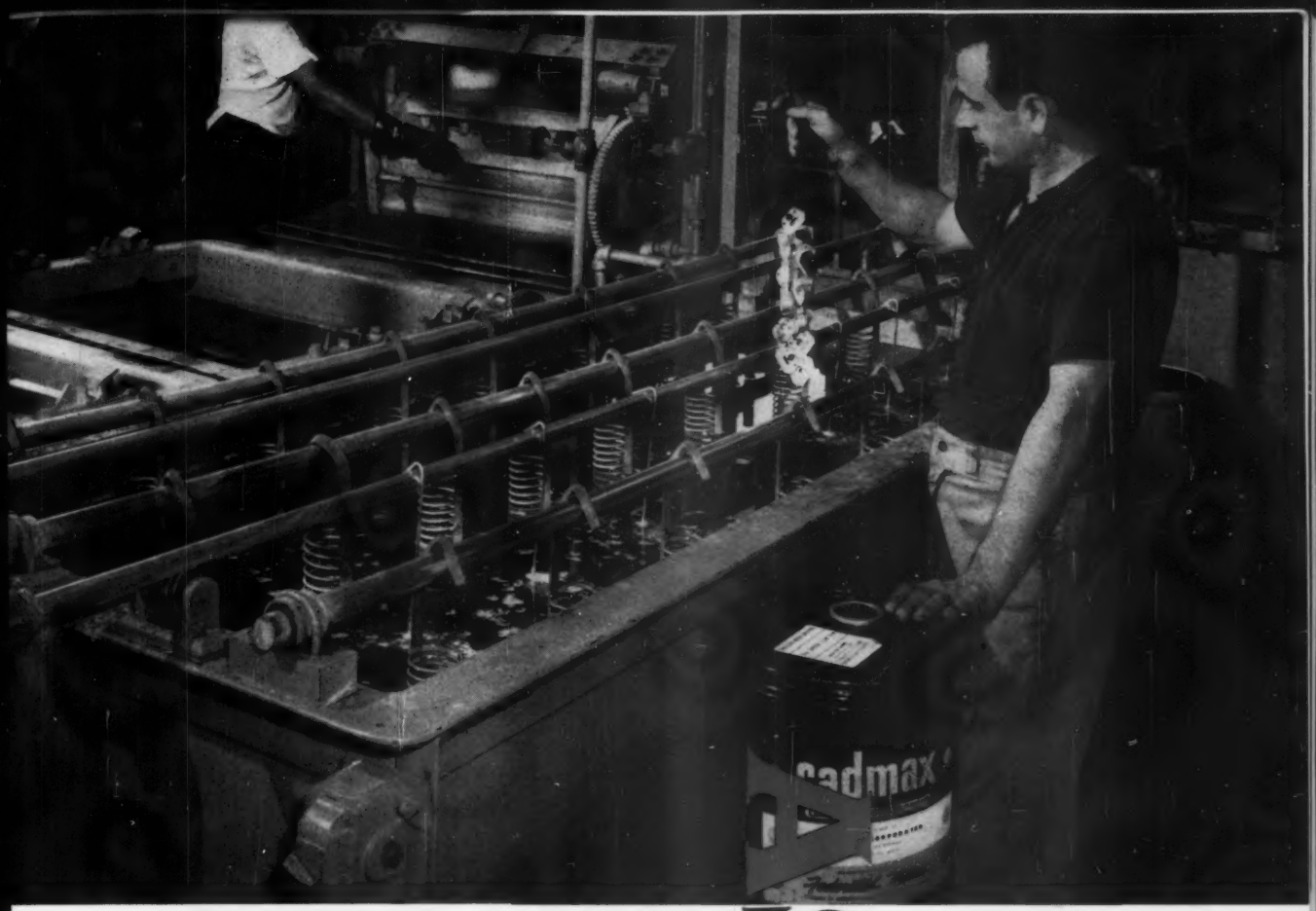
Cream of Tartar...
An excellent additive for brass cleaning compounds. Its crystalline structure acts as an effective abrasive in paste polishes. Chemically active against tarnish.

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MANUFACTURING CHEMISTS FOR OVER 100 YEARS

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ASARCO

AMERICAN SMELTING AND REFINING COMPANY

FEDERATED METALS DIVISION

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St. Louis: Jackson 4-4040

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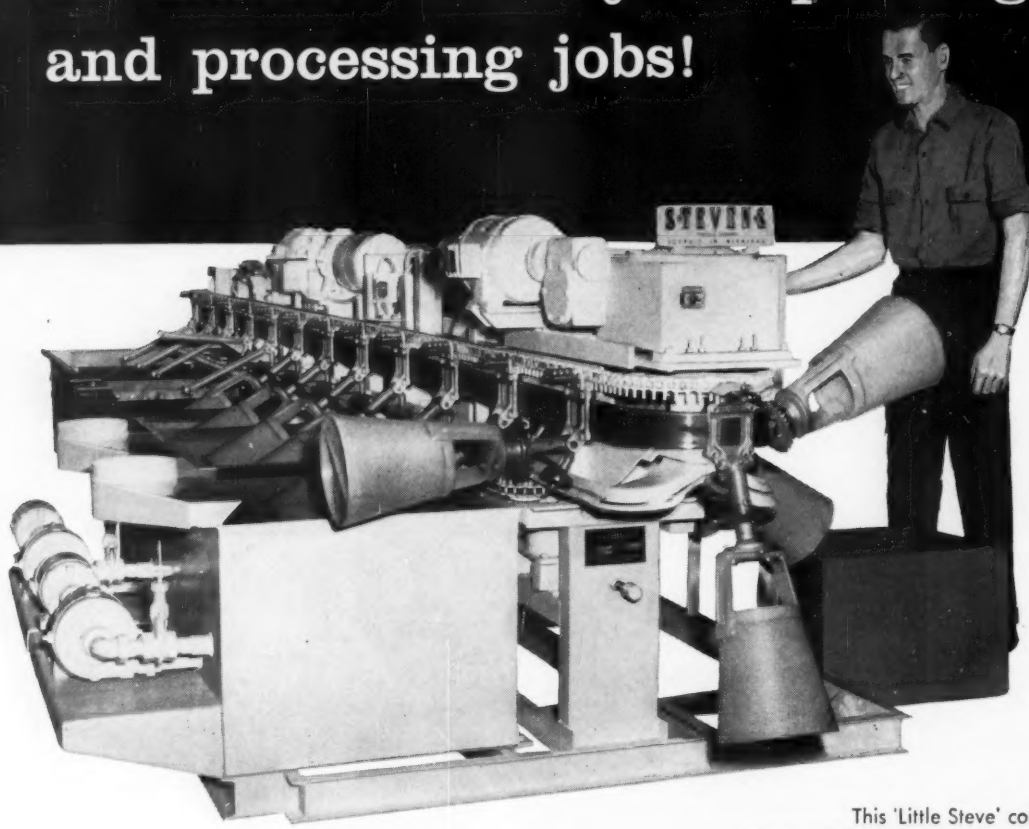
SEATTLE 4, WASHINGTON
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Whiting: Whiting 826
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IN CANADA: Federated Metals Canada, Ltd.
Toronto, Ont., 1110 Birchmount Rd., Scarborough, Phone: Plymouth 73246

Montreal, P.Q., 1400 Norman St., Lachine, Phone: Melrose 7-3591

Now there's a member of the famous 'LITTLE STEVE' family to handle ALL your plating and processing jobs!



This 'Little Steve' combination Barrel and Basket Machine was designed to bright dip small electrical control components in small batches at a 120-barrel-per-hour rate within rigid space limitations. Parts require top quality finish to close tolerance; Little Steve' is only 23 feet long, 6¾ feet wide and normally, 4 feet high.

'Little Steve' automatic barrel machines

Now you can precision plate and process small, intricate parts automatically with the new, low-cost 'Little Steve' Barrel Machine. Floor space requirements are kept to a minimum. Fully automatic cycling, as well as automatic loading and unloading features, provides fast, efficient processing of parts to meet your specific requirements. Stevens popular oblique barrels eliminate the need to open and close covers manually.

This completely new addition to the famous 'Little Steve' family of automatic processing equipment is ideally suited to integrated manufacturing methods. Investigate its many benefits today.

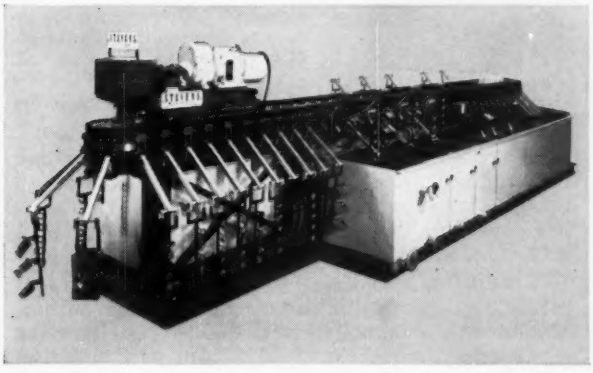
And every 'Little Steve' is designed to give you profitable, high-volume parts finishing capacity in a minimum of space, plus...

- ...low initial investment including installation
- ...floor-level accessibility without catwalks or ladders
- ...ready adaptability to new, integrated manufacturing methods
- ...proven design simplicity and smooth, dependable operation
- ...exceptional flexibility to meet all your plating and processing requirements

'Little Steve' rack machines

For the economical plating or processing of larger pieces, 'Little Steve' Rack Machines offer BIG performance in the smallest possible area. Originally designed to fill the gap between manually operated tanks and large automatic equipment, 'Little Steve' has permitted many manufacturers to automate their parts processing without a great capital investment.

Completely flexible in design and operation, 'Little Steve' can be easily adapted or relocated to meet your changing processing requirements. See how you, too, can realize greater profits from your parts production. Write for complete information on versatile, low-cost 'Little Steve.'



'Little Steve' with conventional stationary hump cam action offers amazing capacity in relation to its size . . . up to 400 racks per hour on normal plating production. This 'Little Steve' will efficiently handle a wide variety of racks or, if desired, a single part can be placed on each carrier arm.



Also new . . . 'Little Steve' with Vertical Lift, or traveling hump cam action, is the truly compact member of the 'Little Steve' family. Narrower tanks save space, cut solution cost. Recommended for production rates under 100 racks per hour. Note convenient height for servicing or rack removal.

frederic b. **STEVENS,** inc.

DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT CLEVELAND
DAYTON NEW HAVEN INDIANAPOLIS SPRINGFIELD (OHIO)

Remember **— When you go *automatic* . . . go STEVENS!**

Want low-cost parts finishing?

NOW—CHOOSE FROM 7 NEW ALMCO VIBRASHEEN MACHINES

TO DO YOUR

- DEBURRING
- DESCALING
- BURNISHING
- SURFACE REFINEMENT
- CLEANING

10 to 100 Times FASTER!

7 SIZES FOR EVERY JOB REQUIREMENT

Model	Tub Capacity	Tub Size, Inside		
		Length	Width	Height
VT-70	¾ gallon	7″	4¾″	6″
VT-71	1 cu. ft.	12″	12″	12″
VT-72	2½ cu. ft.	15″	16″	18½″
VT-75	5 cu. ft.	31″	17″	19½″
VT-77	7 cu. ft.	31″	17″	22½″
VT-712	12 cu. ft.	35″	25″	30⅜″
VT-717	17 cu. ft.	47″	25″	30⅜″



New VT-72 Vibrasheen being unloaded into optional hoist-pan. Note convenient height of controls.

ANOTHER REPORT FROM THE ALMCO ALBUM OF NEW PRODUCTS

IT'S A FACT! With the seven (7) new ALMCO Vibratory Machines, you can expect finishing time cycles 10 to 100 times faster than with standard horizontal barrel finishing equipment. It's a significant production break-through, made possible by creating constant vibratory motion to activate the entire mass of media and parts in the finishing container, as compared to only 20% activation with conventional barrel finishing methods.

The uniform vibratory motion of the media in recessed areas, blind holes and small I.D. dimensions make it possible to obtain optimum results on a multitude of applicable parts with intricate configurations that can not be completely processed in standard horizontal barrel machines.

What's more, this amazing metal finishing machine only requires 50% of the floor space that is taken up by any other machine of this type with a similar capacity. Time and motion is at the absolute minimum with all convenient operating conditions.

Tub features. Holds a 2½ cu. ft. load of parts and media. Equipped with vibrating mechanism adjustable for impact range of from 600 to 2550 lbs.; has a vibration frequency of 3380 rpm with variable drive optional. Pivots through 180° arc. Lined with tough ⅜″ plastisol. Quick-acting cam-lock drain door facilitates flushing of tub.

Investigate today, the ALMCO *Vibra-Sheen way!*

FREE

NEWS ABOUT ALMCO'S NEW PRODUCTS

New Almco Album describes the latest in metal finishing machines, methods and media. Write today for free copy!



ALMCO

Queen Products Division • King-Seeley Corporation

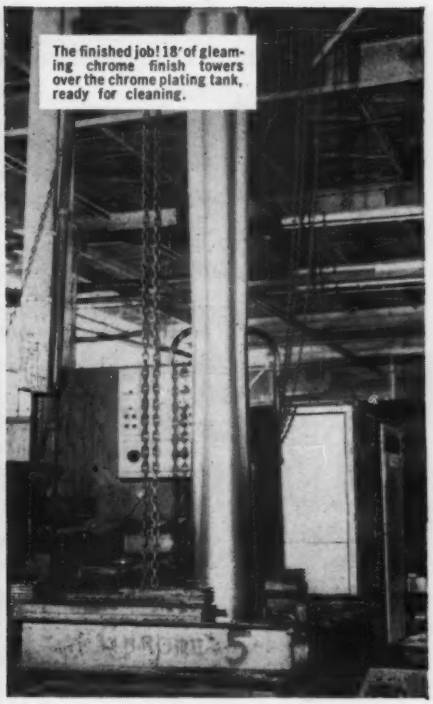
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IN ENGLAND: Almco Division of Great Britain, Ltd., Bury Mead Works, Hitchins, Herts, England



Skilled plater washes down a giant roller for aluminum mill as it is slowly withdrawn from a deep chrome plating tank containing Mutual® Chromic Acid.



The finished job! 18′ of gleaming chrome finish towers over the chrome plating tank, ready for cleaning.

Simmons Vertically Plates 18′ Roller For Aluminum With MUTUAL CHROMIC ACID

Being *vertically* chrome plated for use on the world's largest rolling mill — a 170-inch-wide reversing mill at the Reynolds Metals Company Alloys Plant, Listerhill (Sheffield), Alabama—are giant steel rollers for carrying aluminum ingots.

The Simmons Plating Works of Atlanta, Georgia immerses each roller in a 28′ deep chrome plating tank containing Mutual Chromic Acid. The vertical plating process provides a faster, better quality plating job over the entire surface of the roller. Each roller is plated to .005″ minimum thickness in a standard 33 oz. per gal. chromium plating solution at normal plating temperatures of 130°F.

Like many other skilled platers throughout the country, Simmons relies on high purity Mutual Chromic Acid to provide a chrome plate that gives longer wear and resistance to rust and corrosion. Plating with Mutual Chromic Acid also helps to protect the rollers from damaging or scratching the aluminum ingots they convey.

Mutual Chromic Acid is always 99.75% pure—or better. Sulfate content never exceeds 0.1%. Rigid quality control insures that the chromic acid you get is always the same. This makes it easier for you to control accurately the chromic acid-sulfate ratio of your plating bath.

For information on Mutual Chromic Acid, as well as other Mutual chromium chemicals, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service staff will also be happy to answer your questions.

OTHER PRODUCTS FOR PLATERS

SOLVAY® Caustic Potash • SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide • SOLVAY Methylene Chloride

Allied Chemical

SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast. Send export inquiries to Allied Chemical International, 40 Rector St., New York 6.

SOLVAY PROCESS DIVISION 44-100
Allied Chemical Corporation
61 Broadway, New York 6, N. Y.

☐ Send Bulletin 52, "Chromium Chemicals"

☐ Have a representative phone for appointment

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Abrasive Flap Wheel for Grinding and Polishing



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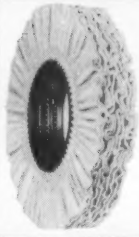
Metal Center Aircooled (bias type) Buff



Schaffner manufacturing company, inc.

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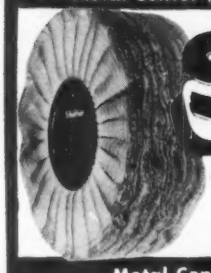
Centerless (bias type) Buff



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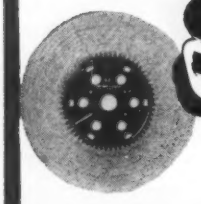
Metal Center (Bias Type) Cloth and Sisal Buff



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Metal Center (Bias Type) Sisal Buff



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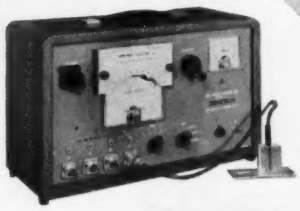
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Metal Center Abrasive Buff



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NON-DESTRUCTIVE
COATING THICKNESS
TESTER

MEASURES METALLIC AND NON-METALLIC COATING THICKNESS

The DERMITRON **instantly and accurately** provides **direct readings** of metallic and non-metallic coatings and films. It is widely used and recommended for measurement of such coatings as: CADMIUM or ZINC on steel; SILVER on brass; ANODIZING, HARDCOAT, PAINT on aluminum, magnesium, etc.

Very simple to operate, the DERMITRON is compact, offering portability for both laboratory and production use. Four patented measuring probes are available for extra-wide thickness ranges from thick to thin deposits and enable measurements on small areas and previously inaccessible areas. You can rely on the DERMITRON NON-DESTRUCTIVE TESTER for any application where coating thickness must be controlled. **Write for current bulletins and price list.**



PERIODIC-REVERSE
AND CURRENT-INTERRUPTION
UNITS

PERIODIC REVERSE UNITS are used with ALKALINE DERUSTING and DESCALING processes for more efficient and effective cleaning operations. **Write for Bulletin PR-AD-1.**

PERIODIC-REVERSE and CURRENT-INTERRUPTION UNITS—for PLATING of SILVER, COPPER, GOLD, BRASS, etc., this fine electronic equipment saves time, money and improves quality. It makes deposits smoother . . . faster . . . brighter . . . easier to polish . . . less porous . . . more uniform. And it's extremely simple to install and operate. **Write for current Bulletin PR-3 and prices.**

All requests for complete details are processed quickly.

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UPA

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starts and ends with DIVERSEY

ZN 77 fast-acting Zincate Immersion Compound for improved electro-plating

Provides an unusually adherent zinc base on aluminum and aluminum alloys. Low concentration—Low drag-out loss. Fast acting, 30 to 120 seconds. Highly soluble, free-flowing, non-caking. Wide temperature range.

DIVERCOAT 2A meets MIL-C-5541 specification covering immersion coatings

Produces a protective chromate coating that resists corrosion, serves as paint base or decorative finish. Fast, easy-to-use. Only one to three ounces per gallon solution at room temperature required.

DIVERSEY NO. 202... light etching alkaline soak tank cleaner . . . activates metal for faster more uniform etch.

DIVERSEY ALUMINUX... original non-sludging, non-scaling alkaline etchant . . . provides finer, more uniform etch.

DIVERSEY NO. 514... for rapid, complete removal of smut. For use at room temperature.

For the products and know-how to meet all your aluminum finishing requirements, consult your Diversey D-Man. Or use handy coupon for specific details.

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CHICAGO ILLINOIS

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Please send complete information on products checked below.

☐ ZN 77 ☐ DIVERCOAT 2A

☐ DIVERSEY NO. 202 ☐ ALUMINUX ☐ DIVERSEY NO. 514

Company_____

Name_____

Title_____

Street_____

City_____ Zone_____ State_____



COMPARE Grav-i-Flo's Finishing Prior To Decorative Plating!

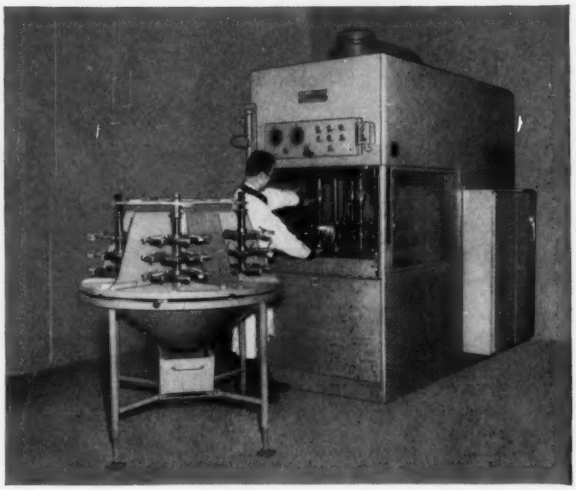
Grav-i-Flo Has Exclusive Materials To Produce Finishes Heretofore Impossible In The Tumbling Field—And On Nearly Every Shape And Size Part By These Two Processes:

TUMBLING



Grav-i-Flo exclusive barrel finishing materials make it possible to obtain finishes in a tumbling barrel that no other process can produce. Grav-i-Flo chips are the most outstanding of all barrel finishing medias on the market for decorative finishing. Many customers ultilize Grav-i-Flo's plant facilities for job tumbling of parts on which they have been unable to obtain satisfactory finishes—and then later install their own facilities.

SPIN-FINISH



Large parts, intricate shape parts not suited to tumbling and previously finished only by buffing, are now finished in production quantities to high lustre surfaces with Grav-i-Flo's Spin-Finish machines. This short, automatically timed operation offers tremendous savings in schedules, labor and floor space. No set-up time required for changing jobs. This is a completely dry process, dust and fume free, eliminating ventilating systems.



Check with Grav-i-Flo Engineering

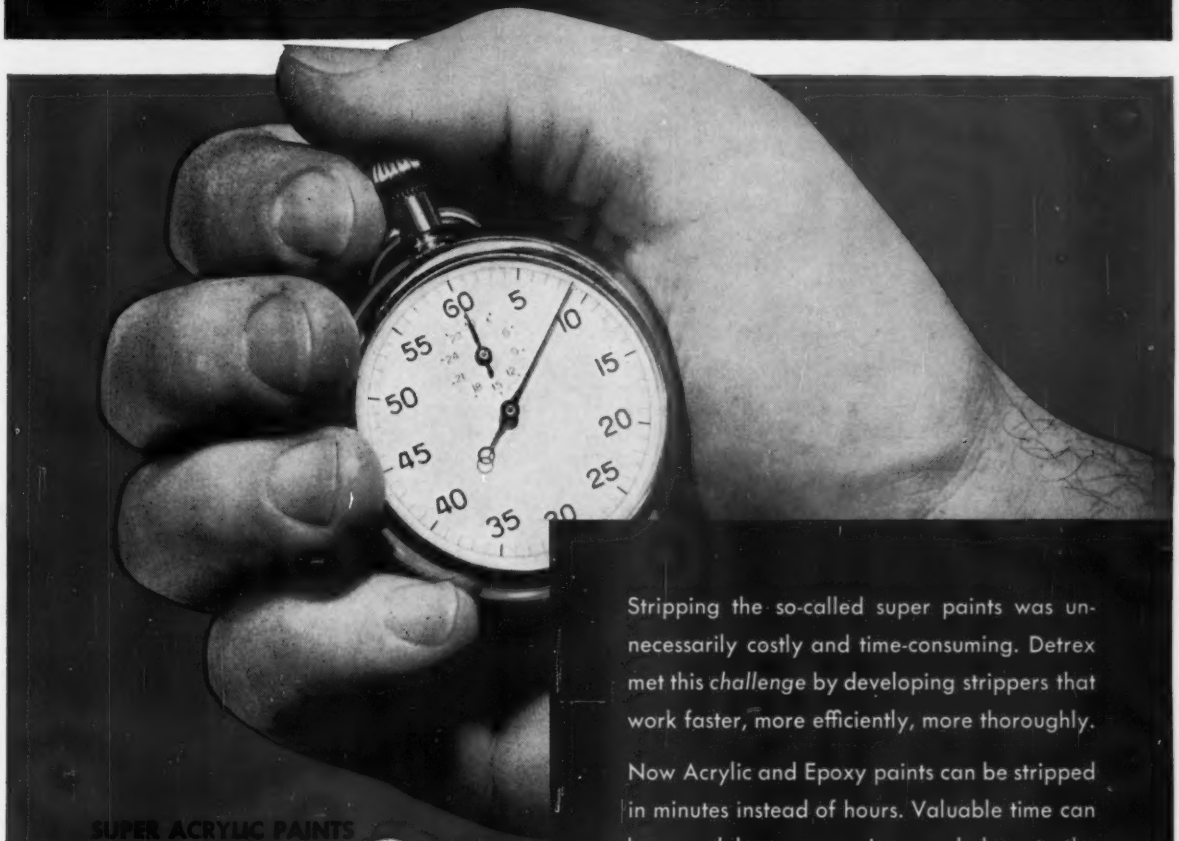
for better finishes prior to decorative plating. Grav-i-Flo personnel were the pioneers—and are still the leaders in tumble finishing.

GRAV-I-FLO CORPORATION

Sturgis, Michigan

DEPT. MF 10

Now You Can Time Paint Stripping With a Stopwatch



Stripping the so-called super paints was unnecessarily costly and time-consuming. Detrex met this *challenge* by developing strippers that work faster, more efficiently, more thoroughly.

Now Acrylic and Epoxy paints can be stripped in minutes instead of hours. Valuable time can be saved by reprocessing needed parts the same day.

Regardless of your paint stripping method — Detrex can assist you in speeding your operation and reducing over-all costs. Why not talk to a trained Detrex field representative now? They welcome the real "toughies".

SUPER ACRYLIC PAINTS
Fast!

MODIFIED ACRYLIC PAINTS
Fast!

SUPER EPOXY PAINTS
Fast!

DETREX CHEMICAL INDUSTRIES, INC.

P.O. Box 501, Dept. MT-1060, Detroit 32, Mich.

MANHATTAN RUBBER LINING PROTECTS COSTLY PICKLING AND PLATING EQUIPMENT ... *Permanently*

STOP CORROSION
STOP CONTAMINATION



- THICK, MULTIPLE CALENDERED SHEETS
- INSEPARABLE RUBBER-TO-METAL BOND
- ELIMINATE DANGEROUS "STRAY CURRENTS"
- NATURAL OR SYNTHETIC RUBBER
- WON'T HARDEN, CRACK OR OXIDIZE
- TESTED UNDER HIGH VOLTAGE

Be *certain* of lifetime protection for your costly equipment and protection against contamination of expensive plating baths. Specify Manhattan lining on your next tank lining job.

Photo courtesy Hanson-Van Winkle-Munning Co.

MANY MANHATTAN LINED TANKS HAVE BEEN IN CONTINUOUS USE OVER 30 YEARS!

ENGINEERED RUBBER PRODUCTS . . MORE USE PER DOLLAR

Rubber Lining Plants at Passaic, N. J. • North Charleston, S. C. • Neenah, Wis.

RAYBESTOS - MANHATTAN, INC.

MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

RM1039-R

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for the "Solution to your Plating Problems" .... come to **JELCO**

NOW-*SPEED* plate in brass with your present solution!

BRASS ADDITIVE ... *for still & barrel plating*

- Increases efficiency and throwing power
- Produces brighter and faster plating
- Allows use of higher current density
- Retards anode polarization
- Eliminates cyanide and ammonia fumes

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A Proven Process!

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Used successfully by job platers and manufacturers

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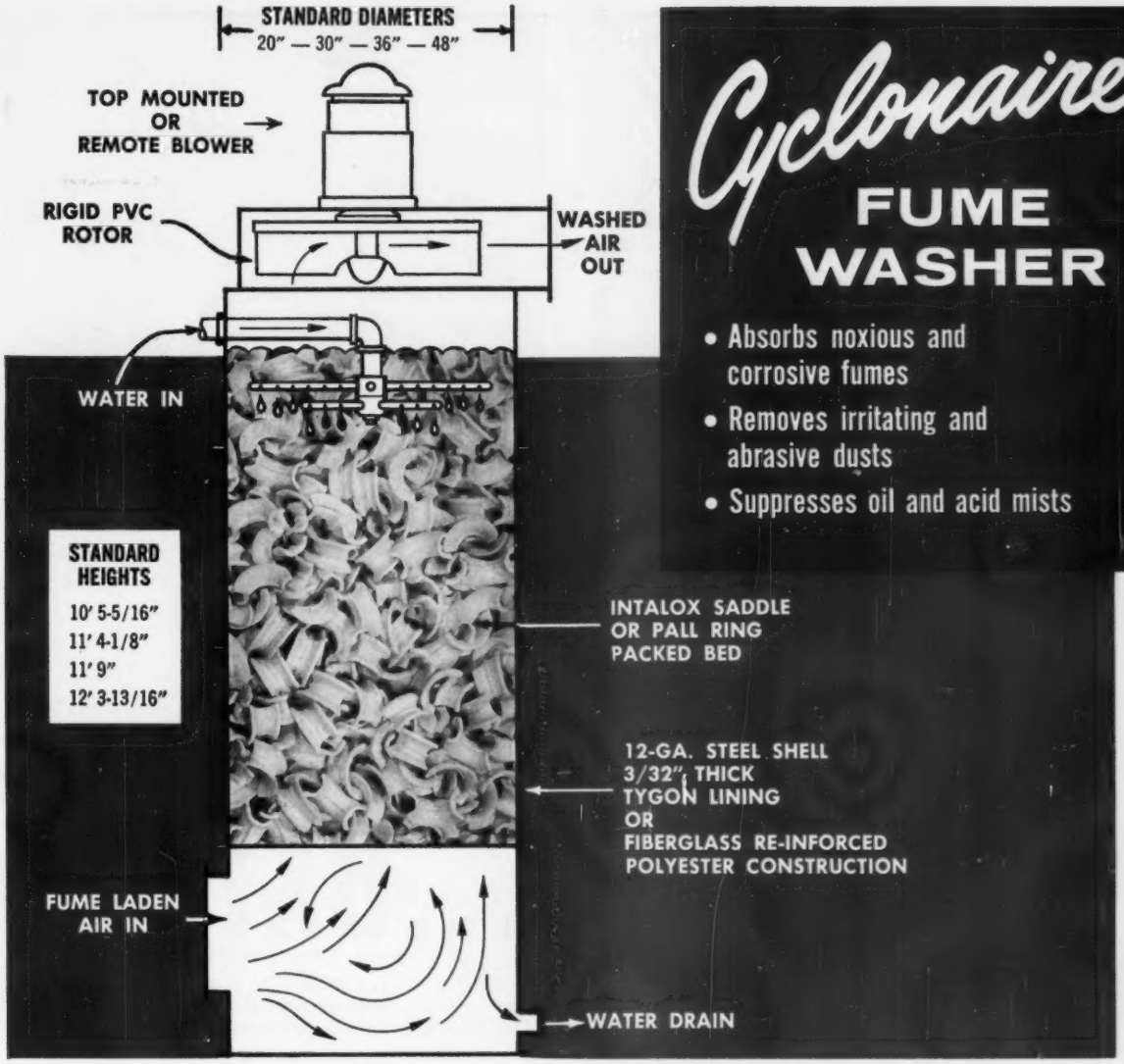
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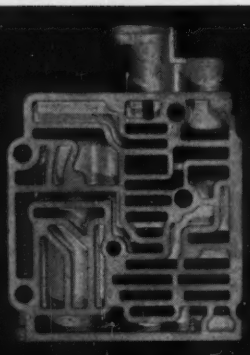
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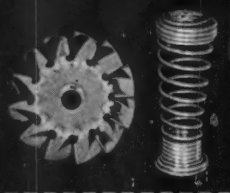
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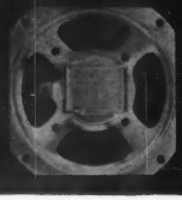




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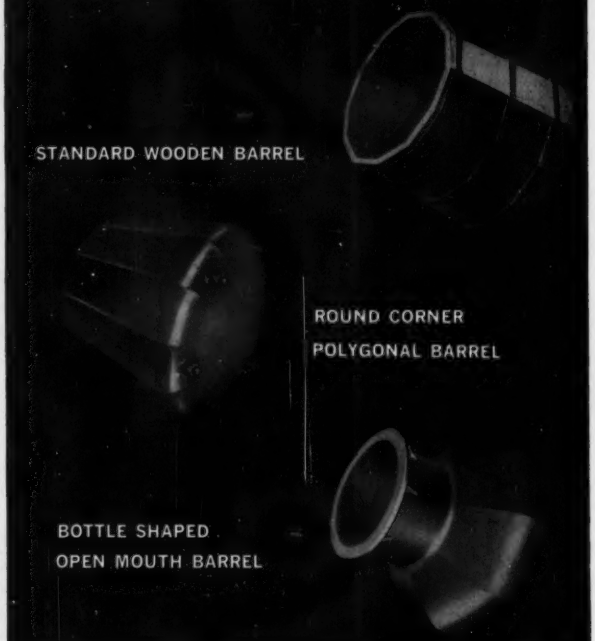
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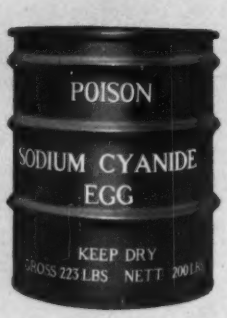
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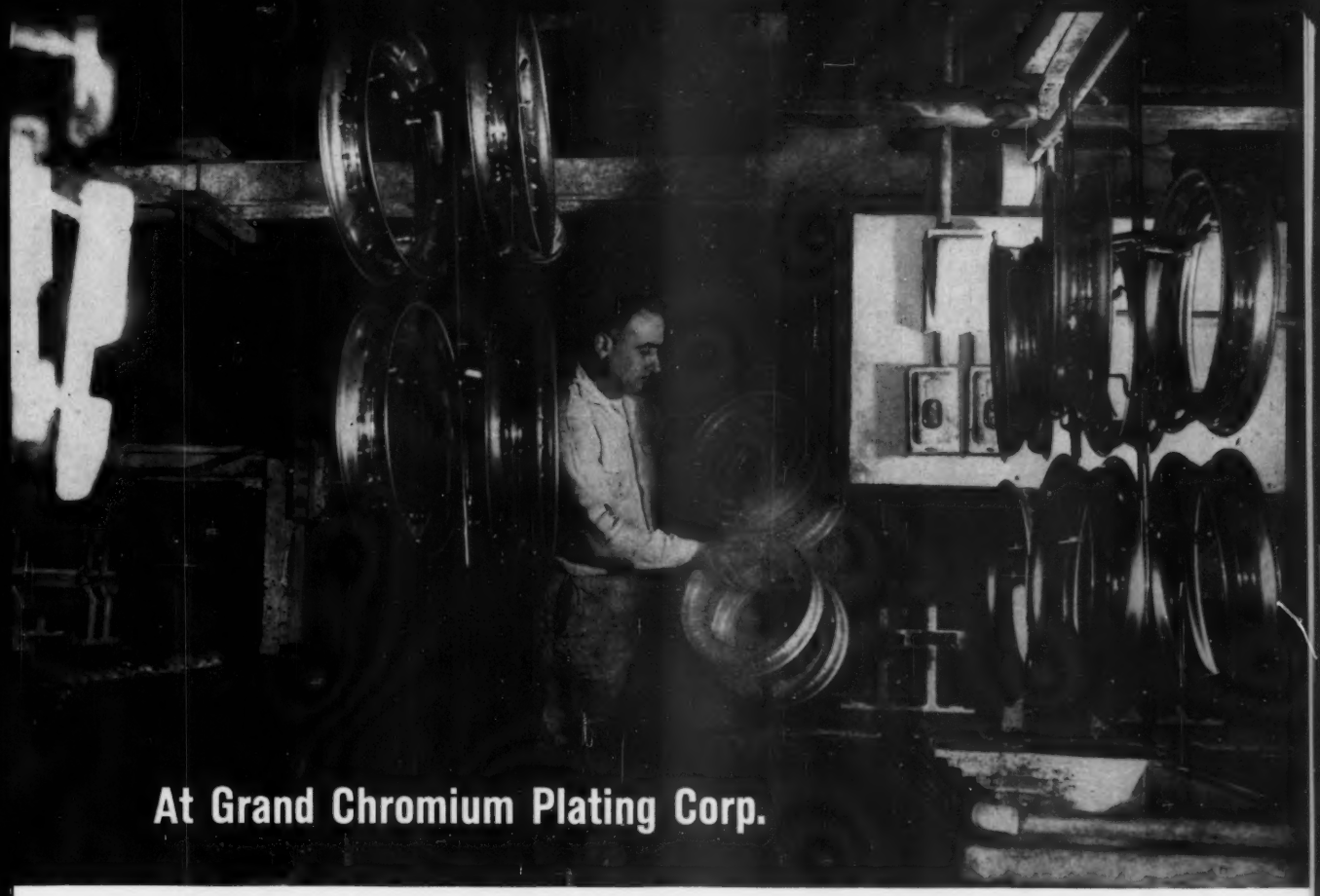
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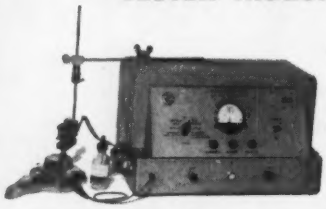
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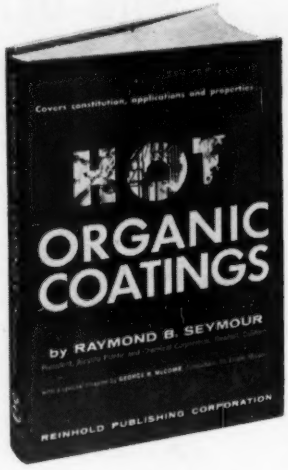
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With a special chapter by GEORGE B. McCOMB
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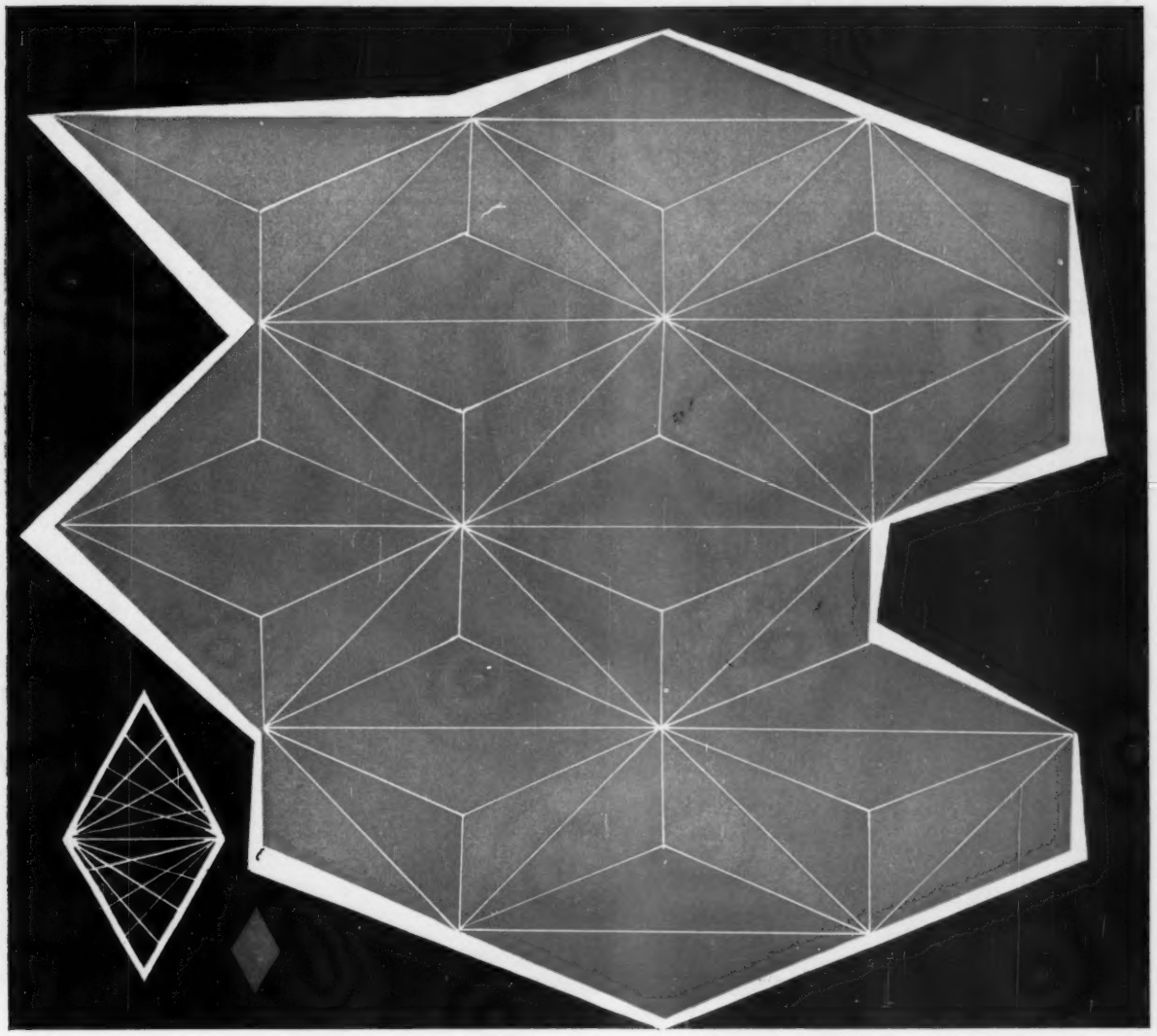
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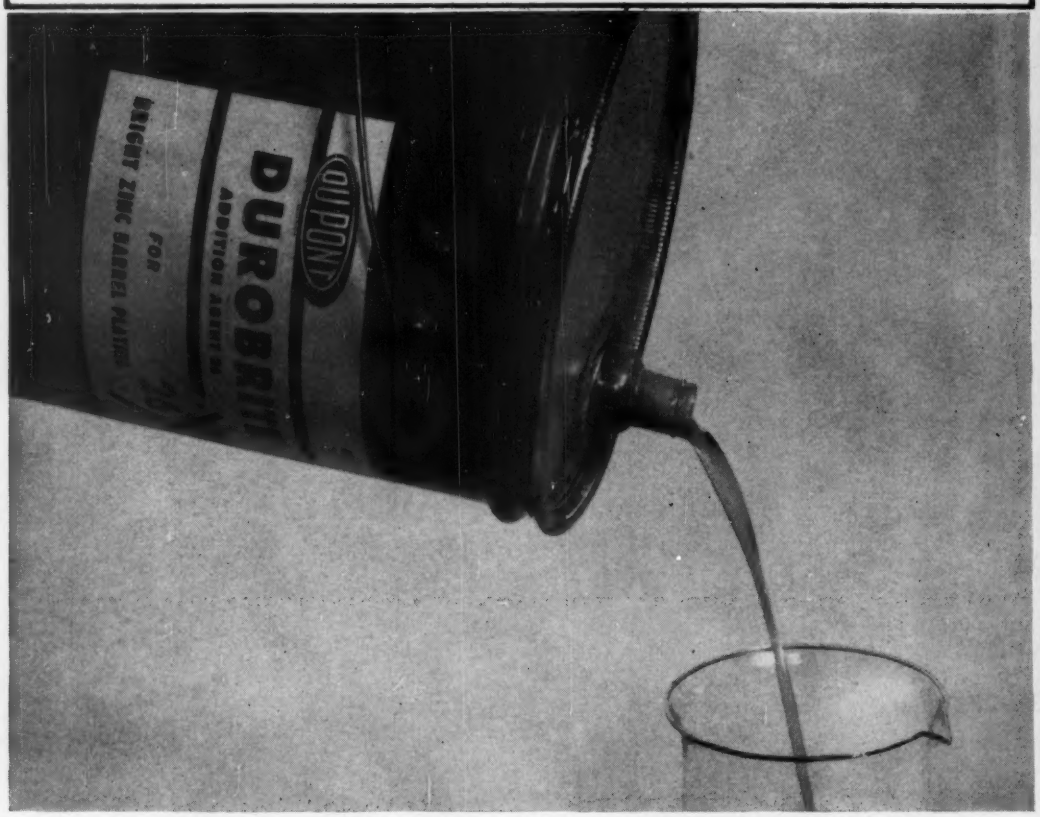
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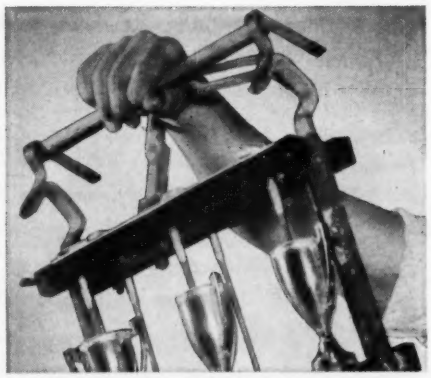
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ESTABLISHED 1903 VOLUME 58 • NUMBER 10 • OCTOBER, 1960

VACUUM METALIZING - AN ORGANIC FINISH

Recently, vacuum coating methods have been developed by which relatively thick deposits of metals, such as cadmium, zinc, and aluminum, can be applied to steel for corrosion protection without hydrogen embrittlement. However, let us concern ourselves with vacuum metalizing as a decorative finish, its predominant field of application, and one generally thought of by the finisher as a metallic process, which it is and which it isn't.

If one stops to consider, what we have is, basically, an organic finish comprising a base coat and a top coat, between which is sandwiched a film of aluminum, only a few molecules thick, for the metallic effect. The transparent top coat may be clear, it may incorporate a dye, or it may be dyed after application, but the final result is no more a metallic finish than would be a metallic lacquer.

The only techniques exclusive to the vacuum operation are racking and rotating to obtain a bright, uniform layer of aluminum; all other problems are connected with the organic coatings. Defects in these are the same as in the usual organic finishes, and it is on their avoidance that appearance and quality of the finished article depend. However, just because we are dealing with an organic finish, it does not mean that only the usual considerations apply, since the base coat is immeasurably more important.

In addition to suitable adhesion, there must be no residual solvent volatility and the coat must seal the microscopic pores in the surface to which it is applied, in order to avoid out-gassing and its ruinous effect on the subsequent vacuum metalizing. It must flow out to eliminate surface imperfections, and cure to the high gloss on which the ultimate finish depends. Finally, it must be completely unreactive with the ultra-thin film of deposited metal but compatible with the top coat applied to protect the brilliant layer of aluminum.

Many materials are commercially available which will meet the requirements of a good base coat and an abrasion-resistant, durable top coat but, obviously, they must be applied correctly. Sags, runs, and orange-peel never enhance a finish, nor are air bubbles, dust particles and similar defects particularly decorative. The base coat must be properly cured to accept a satisfactory vacuum metal deposit, and the top coat must be baked at carefully controlled temperatures. Vacuum metalizing may be, basically, an organic coating process, but we can never lose sight of the fact that it is organic finishing with a different twist.

Nathaniel Hall

Finishing High Performance Naval Aircraft

By George F. Bentinck and Alvin E. Hohman, *Chance Vought Aircraft Corp., Dallas, Texas*

AS military aircraft have progressed to where flights of a thousand miles an hour are common, new problems have arisen which have required radical departures from the usual aircraft coating technology. Temperature extremes for exterior areas have increased upward to 250°F. and down to 65° below zero. Engine oil formulations necessary to lubricate jet engines are also very effective strippers for many paints. Vibration in some skin areas has increased to the point where thicker paint films crack early in their service life. The necessity for weight savings requires the use of light metals, such as magnesium, in some areas while higher temperatures require skins to be manufactured from metals such as aluminum and titanium. The various materials required to be painted with a single system can be seen in Figure 2. For aircraft operating from the salt laden atmospheres of aircraft carriers and beaches, the presence of these dissimilar metals necessitates the use of the best protection available to prevent moisture penetration to the metal surface. A good paint system is needed for the first line of defense against corrosion.

Specification Materials

Rising to the challenge of these conditions, the Navy Bureau of Aeronautics developed an acrylic lacquer system of materials which performs well on most exterior areas of these aircraft. This coating system was presented to the manufacturers of these aircraft and to the Overhaul and Repair Depots who refinish the aircraft. In effect, these activities were presented with a neat packet of primers and top coats, ammunition with which the problems facing them could be attacked. But with it, the challenge was also passed along to use the material in such a way as to result in a functional finish with an appearance suitable for the world's fastest carrier based aircraft. How the Chance Vought Materials Laboratory, Quality and Production department successfully met this challenge is told here.

Surface Preparations

The primary problem arising from the use of these materials was in obtaining adhesion high enough to remain intact after long hours of grueling service and after being wet for days in the water spray resulting from Naval operations. Here a multitude of variables with possibilities of problems emanating from each of them were encountered. Loss of adhesion from glass laminates, aluminum, titanium, and magnesium have occurred at various times through the years. The chief offender has been magnesium. Thus, at the onset of an improved paint system, each of these materials was reviewed to determine that the surfaces were being prepared in the optimum manner to promote good adhesion. A survey of the history of coating performances indicated that improvements should be obtained on the magnesium and on glass-resin laminated surfaces. The dichromate treatment, MIL-M-3171 Type III,* for magnesium, was found to vary considerably in its promotion of adhesion. It was found in the laboratory[1] that the percentage of paint failures

*An amorphous chromate treatment applied to magnesium to furnish a protective film to guard against corrosion and to promote paint adhesion.

1. Pfohl, F. W., and Frances, H. T., Test Methods for Magnesium Surface Treatments. WADC Technical Report 57-195.

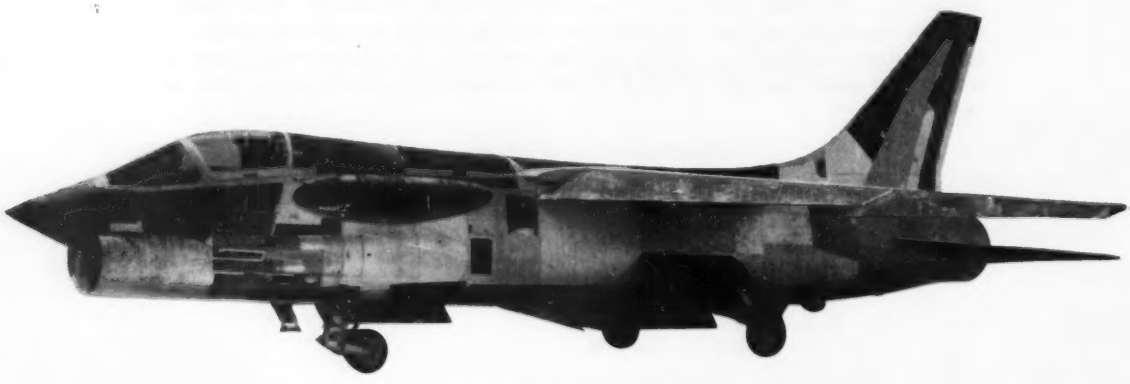


Fig. 1. FBU aircraft prior to painting.



Fig. 2. FBU aircraft finished with acrylic nitrocellulose paint system.

decreased when the part was insulated from the tank and racks during the application of this treatment. Other variables apparently associated with the oxidation of the magnesium surface had a harmful effect on the surface. This is eliminated by wiping the surface with a mild phosphoric acid treatment just prior painting.[1]

Adhesion losses from glass-resin laminates were suspected to arise from parting agents used in manufacturing the laminates and remaining on the parts, or from the extreme smoothness and absence of adhesion-promoting polar groups. This combination gave neithef mechanical nor chemical adhesion. Various cleaning processes failed to improve laboratory adhesion and, consequently, a mechanical roughening was found necessary. Light sanding gave improved results. Optimum preparation was found to be a very light sand blast which resulted in a lightly pitted surface.

Cleaning

The various activities painting high performance aircraft have found by experience that giving parts a "shop primer" just after chemical treatment can lead to intercoat adhesion failures when this coat is aged and soiled before application of the remainder of the paint system. Deleting this shop coat leads, however, to an alternate problem. That is, applying chemical treatments on parts at the time of their manufacture, and having these porous chemical films thoroughly saturated with soils before the aircraft is completely assembled and ready for the paint system to be applied. These soils consist of a variety of materials; oils and salts from workers' hands, various oils used during machining operations, and release agents used during processing. Hydraulic fluid, however, is the soil which predominates and, in fact, seems to find its way to every surface of the aircraft.

Working with this knowledge, a cleaning system was devised which was aimed in shotgun fashion at the great variety of soils. Laboratory tests again preceded production trials and pointed towards pre-cleaning with TT-T-266 specification lacquer thinner.

1. Stander, A., Falkowitz, A., Naval Air Material Center Test Report.

TT-T-266
Dope and Lacquer Thinner Composition

Material	Requirements (% by Weight) Minimum	Maximum
Ketones and/or esters	31	35
Alcohols, total	15	19
Medium boiling alcohol (initial boiling point above 108°C.)	8	—
Hydrocarbons, total	47	51

This thinner contains solvents for each of the solubility classes of organic materials, ketones, esters, alcohols, aliphatic and aromatic hydrocarbons. Hand wiping the surface with this solvent was found to remove the gross amounts of organic soils and leaves only the water soluble materials and traces of the other soils. The remaining soils are left free from the protective cover of the hydrocarbons. A steam cleaning operation using military specification material P-S-751 detergent** had been used as a follow-up and final cleaning step. This was found to be lacking, however, in the very important property of being able to emulsify the hydraulic fluid. For this reason a synergist detergent was added, which was effective in emulsification and removal of the most prevalent soil.

Low Humidity Effects

Aircraft manufacturers in geographical regions where large variations occur in humidity from summer to winter seasons, have long endured what has come to be known as their fall and winter paint problems. During this season of the year a paint system which is performing well, suddenly exhibits a distinctly lower adhesion to metal. This phenomenon has been particularlly evident when a polyvinyl butyral primer formulation known commonly as an "etch" or

**P-S-751 — Steam cleaning compound.
This is an alkaline steam cleaning detergent for use in steam cleaning machines for various ferrous and non-ferrous surfaces. With the exception of a minimum phosphate content 15 percent calculated as P_2O_5 the compound is not required to meet any definite compositional requirements. It must, however, be free of fatty acid rosin, soaps, starch, abrasives, gritty material, inert fillers and free sodium hydroxide.

"wash primer"* is applied to magnesium. Although this has been suspected to be a weather-connected trouble, laboratory facilities for spraying paint in controlled temperatures and relative humidities have been lacking. Several years ago a study was begun in which test panels were sprayed in a paint hangar with humidities varying from ten to seventy per cent. As the data were gathered, it became evident that adhesion of the wash primer to the magnesium surfaces was low on panels in which the wash primer was applied and cured at low humidities. Aircraft painted during this test period were all tested for adhesion. Records of these tests (see Figure 3) showed that adhesion failures occurred in a very high percentage of tests when painted in an atmosphere with less than 30% relative humidity. The records also showed that there were a surprising number of days when the outside humidities were reduced below this limit in the painting facilities by heating the more moist cool air to comfortable working temperatures. Thus, as an initial corrective action, the floors around the aircraft were wet prior to painting as an expediency to raise the humidity to above the 35 per cent level. Steam jets have now been installed for a more convenient humidity control method.

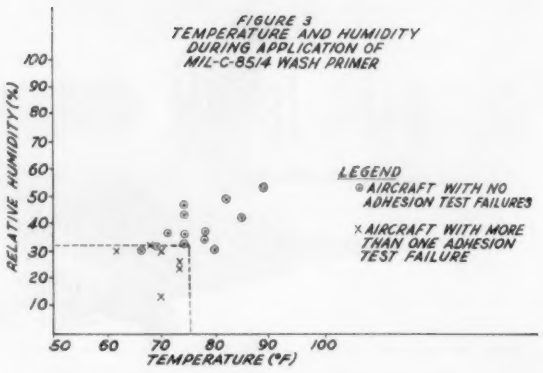
***COMPOSITION OF "WASH PRIMER," MIL-C-8514 (AER)**

	Pounds per 100 gallons of mixed material	*Gallons per 100 gallons of mixed material*
Ingredients of resin component (80 gallons)		
Polyvinyl-butyral resin[1]	56	6.10
Zinc Chromate (insoluble type)[2]	54	1.59
Magnesium silicate[3]	8	0.35
Lampblack (Spec. TT-L-70)	0.6	0.04
Butyl alcohol, normal (Spec. TT-B-846)	125	18.40
Ethyl alcohol (grade III of Spec. O-A-396)	380	55.70
Ingredients of acid component (20 gallons)		
Phosphoric acid (Class A of Spec. O-P-313)	28	2.0
Water (maximum)	25	3.0
Ethyl Alcohol (grade III of Spec. O-A-396)	102	15.0

1. This resin must be a polyvinyl partial butyral resin containing only polyvinyl butyral, polyvinyl alcohol, and polyvinyl acetate in the molecule. The resin shall be one of two types conforming to the following requirements:

	Type I	*Type II*
Polyvinyl alcohol, percent by weight	18.0 to 20.0	10.5 to 13.0
Polyvinyl acetate, percent by weight, maximum	1.0	1.5
Viscosity:		
6 percent in methanol, centipoises at 20°C.	13 to 18	----
5 percent in ethanol (95 percent), centipoises at 25°C.	----	18 to 28
Specific Gravity	1.05 to 1.15	1.05 to 1.15

2. The zinc chromate must be of an insoluble type, showing an analysis 16 of 19 percent CrO_3, and 67 to 72 percent ZnO, and not more than 1 percent water soluble salts.
3. The use of an extra fine variety of magnesium silicate such as Whittaker, Clark, and Daniels #399 SF or equivalent, is preferable in order to produce a finely ground material and a smooth film.



Correcting Primer Lifting

The tie coat between the wash primer and the fluid and heat resistant acrylic top coats is an alkyd-nitrocellulose resin mixture which is defined by Specification MIL-P-7962.

FORMULATION OF CELLULOSE-NITRATE MODIFIED ALKYD PRIMER, MIL-P-7962

SOLIDS CONTENT

Lacquer primer	*Requirements* Min.	Max.
Total solids (percent by weight of lacquer primer)	45	----
Pigment content (percent by weight of total solids)	47	53

PIGMENT CONTENT

Pigment	*Percent by weight* Min.	Max.
Zinc yellow (Specification TT-Z-415)	50	----
Siliceous extenders	----	50

NONVOLATILE VEHICLE CONTENT

Ingredients	*Percent by weight* Min.	Max.
RS ½-second nitrocellulose[1]	23	27
Alkyd resin[2]	73	77

1. To adjust to the correct viscosity, it is permitted to substitute with 5- to 6-second nitrocellulose in any quantity.
2. The resins shall consist of phthalic alkyds, containing a minimum of 34 percent phthalic anhydride, and a minimum of 43 percent oil modification on a nonvolatile basis. The use of rosin or phenol resins shall be prohibited.

VOLATILE CONTENT[1]

Ingredients	*Percent by weight* Min.	Max.
Esters and ketones (total)	30	----
Medium or high boiling[2]	20	----
Alcohols (total)	15	22
Medium or high boiling[2]	10	----
Hydrocarbons	----	50

1. The volatile content should not contain benzol, chlorinated solvents or other substances of similar toxicity under normal conditions of usage.
2. Boiling above 108°C. (226°F.).

Although performance of the tie coat has been good, one defect has reared its head at various places around the country. This is lifting or wrinkling of the primer at the time of application of the lacquer. Laboratory trials on the potential causes showed a number of factors which could cause the trouble in production. Soil such as paint stripper or hydraulic oil on the

metal was found to bleed through the wash primer and cause a lowered adhesion between the wash primer and tie coats, which resulted in lifting. A vulnerable time period was discovered after several hours curing of the MIL-P-7962 tie coat and before the full cure had occurred. This was thought to be associated with a partial cure when the polymer is in the initial stages of formation and is highly soluble in the solvents of the lacquers which follow. A change in the formulation to the alkyd resin suggested in the control formula in the specification lowered the susceptibility of the primer. The drying time of the tie coat prior to overcoating was controlled to the least amount in excess of one hour that was possible, and the amount of solvent to contact the primer was decreased to the least which could be used in the acrylic lacquer. Thus, the polymer chains are so short that solvent addition from subsequent coats acted more as diluents of the liquid paint than a damaging influence on the tender yet uncured film. With this action, lifting ceased to be a problem.

Improving Permeability

Because Naval aircraft must operate in areas where they may often remain wet for days, the exterior paint* is required to maintain a high level of adhesion in this water soaked condition. When one of the metals painted is as reactive as magnesium, the importance of establishing a water barrier around the skins is doubly important. It was evident that increasing thickness of the paint system would decrease the permeability proportionally in accordance with Ficks Law of Permeability.** However, in the case of vibrating aircraft surfaces, this increase in thickness is limited by fatigue cracking of coatings, which in turn is accelerated by increased coating thickness. It therefore became important to use the least permeable material in order to obtain protection within the film thickness limitations. Experience indicated this thickness to be a maximum of three thousandths inch on many surfaces. Laboratory tests again were used to determine that the polyvinyl butyral resin wash primer coat has a lower permeability to water and water vapor than the nitrocellulose alkyd resin tie coat, as would be expected from the lower water solubility of the pigments used in the wash primer than in the tie coat. In order to increase the water resistance of the coating system, without decreasing the flexibility, the wash primer thickness was increased while the MIL-P-7962 thickness was decreased. When these major engineering difficulties with the system had been overcome, the responsibility for a consistently good finish system was placed on the shoulders of the Manufacturing and Quality Control Departments.

Pre-Production Trials

Prior to incorporating a new paint system into a production line moving at a relatively high rate, it was considered prudent to evaluate the effectiveness of the applicable material and process controls on a trial basis under existing production conditions. For this purpose, several aircraft were scheduled at intervals to be painted with the acrylic system prior to the permanent incorporation point for this finish. These trials were pre-planned to provide as much information as possible regarding the paint system. Sufficient time was allowed for testing and evaluating the finish during and after application. It was apparent after conducting the trials that adhesion testing of the paint film under production conditions would present a formidable problem due to the curing char-

*The outer finish coats are composed of an acrylic-nitrocellulose resin formulated as shown below (MIL-L-19537 for gloss).

COMPOSITION
PERCENT BY WEIGHT

Material	*Minimum*	*Maximum*
Pigmented Colors[1] *		
Nonvolatile	40	—
Volatile	—	60
Clear		
Nonvolatile	30	—
Volatile	—	70
Volatile Portion[3]		
Total Ketones[5]	55	—
Medium boiling[3]	27.5	—
Total Alcohol	—	6
Toluene[4]	—	41
Nonvolatile Vehicle Solids		
RS-½ sec Cellulose Nitrate[7]	23	26
Resins[6]	54	57
Plasticizers[8]	19	21

1. For jet, insignia blue, insignia red, and glossy sea blue, nonvolatile should be 32 percent minimum, volatile 68 percent maximum.
2. The minimum boiling point of the volatile portion shall be not less than 75°C. (168°F.).
3. Boiling above 114°C. (237°F.).
4. Aliphatic hydrocarbons shall not be used.
5. Slight changes in the tolerance of the solvents will be permitted, along with a substitution of small amounts of comparable boiling range solvents for the ketones to provide for the use of pigments in the form of dispersion pastes.
6. *Resins* — The resin must be a copolymer of methyl methacrylate and other acrylic esters, with the methyl methacrylate portion being the major part of the copolymer. The viscosity (40% solution in toluene) shall be 480 to 640 centipoises at 30°C. (86°F.).
7. *Cellulose Compounds* — The cellulose compounds must conform to Type II, Specification MIL-C-5538.
8. *Plasticizers* — Chemical plasticizers should consist of diisooctylphthalate or dioctyl phthalate.

**Fick's law can be stated simply as follows: For a given porous paint film of uniform chemical nature and porosity, with the same conditions of temperature, time and chemical content of the fluid, the permeability of the paint film is inversely proportional to the thickness of the film.

This is taken from the more general Fick's Law of Diffusion formulated in 1855 by A. Fick. This stated the relationship between the amount of diffusing substance dS and the concentration gradient as:

$$dS = -Dq \frac{\frac{dc}{dx}}{dt}$$

Where D is the diffusion coefficient; $\frac{dc}{dx}$ is the concentration gradient for the interval dx; dt is the elapsed time; and q is the cross sectional area of the amount of substance that, at a unit concentration gradient, passes a plane of unit area in unit time.

acteristics of the finish system and the curing environment to which it would be exposed. The ultimate solution to this problem is described in a subsequent paragraph.

Material Control

Quality assurance provisions for the materials used to protect high performance aircraft in marine environments were considered critical. All paints and primers employed in the acrylic system were procured from qualified sources and conformance tests were conducted on each batch of material by the manufacturer prior to shipment. Acceptance tests and periodic control tests conducted by Chance Vought were designed to verify the performance characteristics of the materials rather than to quantitatively or qualitatively analyze the formulation. Specific gravity, viscosity, miscibility, appearance, application characteristics, color, gloss and adhesion are tested. The adhesion tests are conducted on magnesium and aluminum test panels to duplicate surfaces encountered on the aircraft. In-process control of materials is accomplished by spraying test panels and checking the results just prior to applying each coat of material to the aircraft. Improperly mixed materials can readily be detected by this procedure before they are applied to the aircraft.

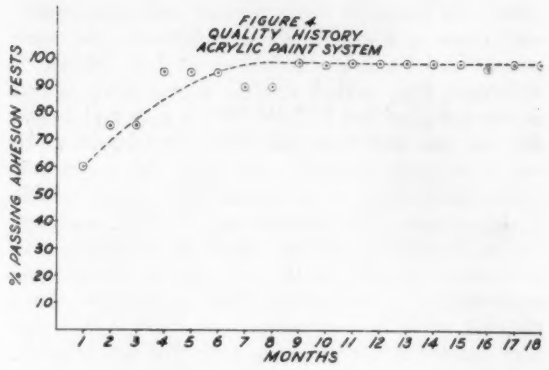
Process Control

Since the bond between the metal surface and the wash primer is the first critical link in the chain of materials in the finish system, the control of surface cleanliness is essential. Surface condition is determined by means of water break tests performed after solvent and steam cleaning operations. This test, although not considered entirely reliable, is still the only known practical means of qualitatively checking large surface areas for cleanliness. Surface treatment solutions and application procedures must be controlled to assure a satisfactory paint base. The pH of the aircraft exterior surface is spot checked for an acid reaction, prior to application of wash primer. The most effective control of cleanliness and surface preparation is obtained through careful training and supervision of the individual workman.

All primer and paint spray operators are trained and certified prior to production application of new materials. Proper techniques and equipment adjustments are demonstrated on test panels. Personnel responsible for mixing paint materials are trained and certified in material identification, proportions and handling requirements.

During application of finish coats, film thickness is closely controlled. Thickness measurements are made on each coat prior to application of the succeeding coat. Total film thickness for the paint system must be within specification limits to provide the desired protection and flexibility.

Due to the deleterious effect of improper temperature and humidity control on paint adhesion, it is necessary to continuously monitor conditions in the paint hangar during finishing operations. Strict adherence to specification requirements is maintained by adjusting heating and ventilating controls. In cases where it is not possible to obtain the required temperature and humidity relationship, paint operations are suspended temporarily.



Final Finish Testing

The ultimate goal of material and process controls is an end product with the desired properties. In the case of painting aircraft, it is also possible to test and verify certain characteristics of the final finish system and thereby be assured of the quality of the final product and the effectiveness of in-process controls. The final inspection of the finished aircraft consists of the usual visual examination for defects such as sags, runs, color mismatch, improper or missing markings and stencils. The final test of the aircraft finish is a 16 hour wet tape adhesion test required for this type of paint system by company specifications. During the pre-production trials, it became apparent that the curing characteristics of the acrylic paint system under varying atmospheric conditions would influence the results of adhesion tests to the point that it would not be possible to obtain reliable test results after a reasonable air drying period. Production schedules precluded the possibility of holding aircraft in the paint hangar pending complete cure of the finish. No force drying facilities were available at the plant that were adequate from a heating capacity or were large enough for the aircraft. Thus, it was decided to remove access doors from random locations on painted aircraft and to force-dry and adhesion-test these doors. A number of time-temperature cycles were investigated before satisfactory force dry conditions were established in which test results correlated with those obtained from long term room cures. The test procedure finally adopted consists of removing access doors from the painted aircraft after one hour air dry, force drying the doors for the prescribed time and temperature, cooling to room temperature and then conducting the 16 hour wet tape test. The entire test cycle from the time of application of the last finish coat to completion of the wet tape test requires approximately 24 hours. Using this test procedure, it is possible to verify paint adhesion while aircraft marking and stencils are being applied. The acrylic paint system quality history for the first eighteen months of production using the 16 hour wet tape test as quality criteria is shown in Figure 4.

(*Continued on page* 55)

Modern Polishing and Buffing

By Stanley P. Sax, *Executive Vice-President, American Buff Co., Chicago, Ill.*

GENERALLY speaking, buffing, which includes coloring, or color buffing, follows polishing, which, in turn, follows grinding in amount of stock removal. Depending on the metal and part to be finished, and the type of finish required, any of the three operations may be unnecessary. By proper methods, buffing often can eliminate the need for polishing, and polishing can eliminate the need for grinding. The fewer operations needed, the lower the finishing costs. Polishing and buffing are not employed primarily to produce precise dimensions, as are grinding and lapping. Polishing is done with coated abrasive belts, discs and wheels, or set-up wheels of felt, hide, or cloth sections glued together. Buffing and coloring are usually done with buffs.

In the past fifty years the main historical factor leading to modification in buff design has been the increasing complexity of contours to be finished and increasing automation in buffing. The transition from hand machines to semi-automatics and automatic buffing machinery, with their increased pressures, increased dwell time, and decreased rest time, has led to the need and development of better ventilated buffs. To a great degree, during this period, the evolutionary trend has been that solid cloth buffs have given way to buffs with various types of composition centers (cardboard and cloth), to steel center buffs, both removable and permanent, and to centerless buffs.

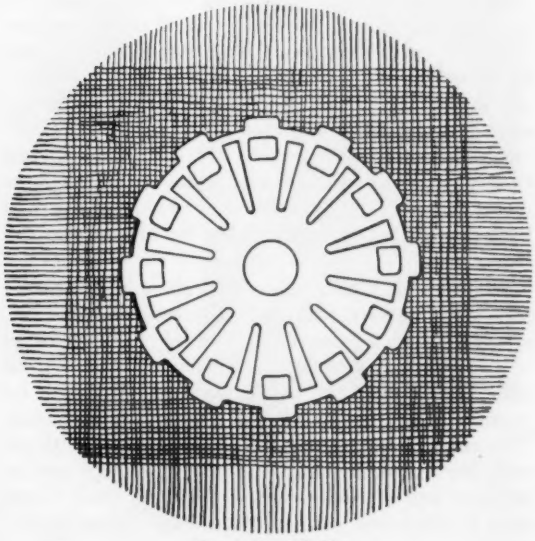
Types and Strength of Materials

Different cloths are used to accomplish different purposes. The industry has moved from the use of unspecified pieced goods and inferior seconds, sorts, culls, and reject low-count, light-weight material to uniform, specific high count, heavy weight material, and has increased the use of sizing and stiffening.

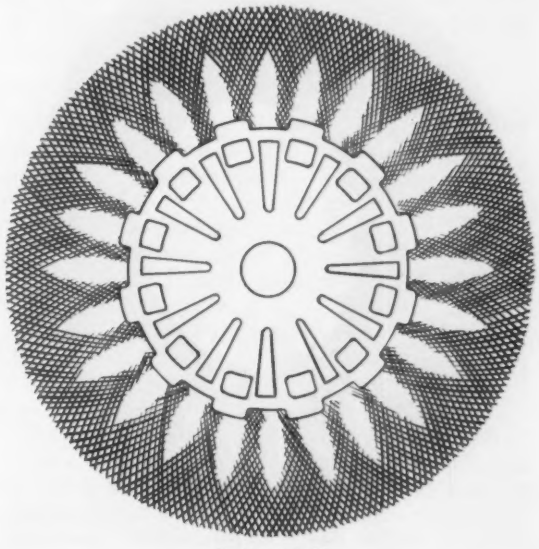
Thread Count and Weight of Cloth

Warp (lengthwise)	*Filler (Crosswise)*	*Cloth weight (Linear yards per lb. of 40" wide material)*
48	44	4.85
64	68	3.15
64	68	3.50
68	76	2.93
80	80	4.00
80	92	3.50
86	93	2.60
86	93	2.50
86	93 treated	

The 86/93-2.50, 86/93-2.60, and 64/68-3.15 are the most commonly used. The lower weight numbers represent heavier material (the fewer yards per lb., the heavier the material). The lower thread count and lighter weight materials are used for softer metals and plastics, and for light cut and color. The closer woven,



Conventional buff.



Puckered buff.

heavier weight and stiffer materials are used for cutting operations.

Domet flannel (with nap on both sides) and Canton flannel (nap on one side and twill on the other) are used where the other materials tend to scratch, or fail to produce a high enough luster. Canton flannel is available in 6-oz., 8-oz., 10-oz., and 12-oz. weights.

Wool buffs, made of carefully selected woven material, are used on plastics, soft metals, and on sterling silver, where they help prevent tarnishing. Russet (bark-tanned) sheepskin and white alum (alum-tanned) sheepskin are used for metals that contain lead, to prevent surface drag or smear. Russet is used for cut and alum for color.

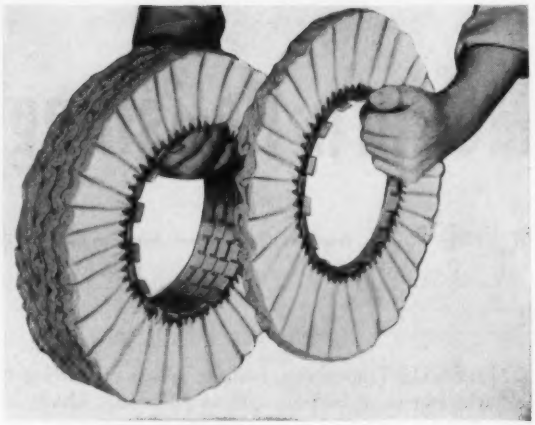
One item the buff manufacturer must control to insure good performance of his buff is the strength of the material used in the buff. In any thread count, or any weight material, the strength varies tremendously. This strength can and should be tested and material shipments rejected if they do not come up to standard. The reasons for strength variation within the same thread count and weight are variations in quality and staple length of the raw cotton and methods of spinning the yarn. Other factors are the size of the yarn and the treatment with starch or resin during weaving of the material.

Puckered Buffs

A great advance in the buff manufacturing art was the development of the puckered buff. The threads form an X at the periphery. Each is held at a 45 degree angle by every other cross thread. This tends to overcome the disadvantages of fraying or raveling. An easy test of the advantages of the puckered buff is to hold a wheel rake against a conventional buff. A cloud of threads will fly off. Hold the rake against a puckered buff (made with material on the bias) and threads will not fly off. Puckered construction also shows a substantial saving in composition. Furthermore, due to manufacturing methods, cloth down to the arbor hole is not necessary.



Centerless puckered sisal buff.



Assembly of centerless buffs.

These buffs are produced by cutting the 40″ rolls of material into strips at a 45 degree angle and sewing these strips to form continuous rolls of biased fabric. The fabric is wrapped around a split drum with a channel in the split. A loop of piano wire, or steel blades in an Iris machine are among the methods used to pull the cloth to the desired inside diameter within the channel. This results in the puckered nature of the buff. A continuous metal ring, piece of string, or staples may be used to hold the cloth at the buff's inside diameter.

Buff Centers

Cardboard discs may be inserted to adapt the center of the buff to the shaft. Cloth covers are then sewed on to keep the cardboards from falling out when the buffs are mounted on a shaft.

Greater production of bright metal parts required greater use of automatic machinery, greater speeds, pressures, and dwell time, with less index or rest time. This caused more heat build-up in the buff wheels. The puckered, or ruffled characteristics of these new type buffs allowed them to run cooler than the older types. However, operating conditions caused even these buffs to run too hot. Drying out of the cloth, scorching, and actual bursting into flame sometimes resulted. To alleviate this fire hazard, air holes may be drilled into the centers. In addition, cardboard flutes are sewed on to direct this air flow, or cardboard centers are pressed thinner with ridges to guide the air. These steps all help.

High speed, high production buffing took another giant step forward with the introduction of the steel center ventilated puckered buff. Steel clinch teeth are often used to clinch the cloth. The buff has a metal plate, perforated for ventilation and embossed for strength, with lips that fit both sides of the steel teeth. This constitutes a center which is discarded with the buff. Metal inserts with lips on one side only may be salvaged and re-used. Properly designed, these inserts snap in place and hold onto the buff unless forcibly pushed out by hand. Those that are poorly designed

fall out during handling. Some must be inserted with a press and knocked out with a hammer.

Another center, which is still in use, is the welded double plate. The two plates must be aligned carefully and spot welded many times. Still another frequently-used metal center is very light in weight and involves the use of staples.

Industry standards for sizes of buff centers are 3″, 5″, 7″ or 9″. The proper size for a specific purpose depends on how far down the buff can be used before (1) the surface speed reduces to a point of inefficiency or, (2) flexibility reduces to a point of inability to follow contours. This increasing rigidity is due, partly, to the fact that most buffs are designed with as much material in the inside diameter as they have at the outside diameter.

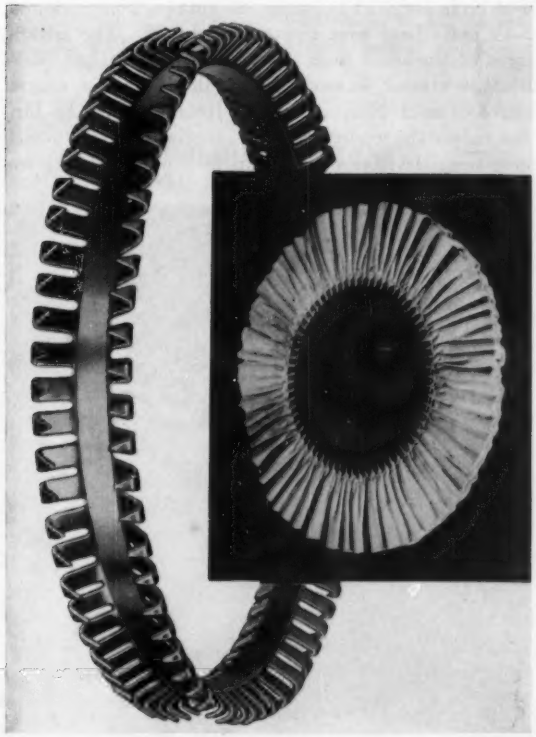
Other things being equal, the smaller the inside diameter, the larger the outside diameter, and the greater the density that can be used, the better. This will result in fewer changeovers, less labor and loss of production due to downtime and, of course, less machinery requirements and other costs. The buff assembly charge remains the same, and the only additional cost is material.

Density variations may be accomplished by greater or lesser amounts of cloth in the wheel. Puckered buffs are rated by numbers. The higher the number, the greater the cloth content, buff density, and pucker of face. Higher density of the buff increases cut. Increased pucker reduces streaking.

Buff Construction

OPEN FACE:

In the open face construction, there is less tendency



Steel clinch ring and open center buff.



Buff densities and construction. Left to right: 0, 2, 4, 6 closed face straight and open face spiral.

to load, pack, clog, and form ridges that streak. However, the open face design buff is frequently insufficiently dense. In order to do the best buffing job, the optimum face design must be combined with optimum density, pressure, speed, power to maintain speed, angle to the part, cloth (strength and compound absorption ability), ventilation, contour following ability, and other design features.

In the open face design, material may be wound singly, or in groups of two, three, four, or more plies. While the amount of material varies according to plies, it also varies according to the amount of shirring, the count, weight, and treatment of cloth. Open face buffs may be straight wound or spiral wound. There is a certain corkscrew, or cross-cutting action in the spiral wound buff design that helps overcome streaking.

PLEATED BUFFS:

The pleated buff frequently achieves improved buffing results, because the cloth is permanently knife creased, so that it presents more changed angles of material to the surface to be finished. This results in less tendency to streak and better coloring characteristics. If properly constructed and suited to the job, better cutting is also achieved.

CENTERLESS BUFFS:

After the steel center buff was on the market a good many years, the centerless buff was developed. By interlocking, the buffs support each other and only require end plates or flanges to adapt the wheel to the shaft. The centerless buff results in several superior design characteristics. Superiority is due to the cooler running, air conditioned open center and pre-assembled interlocking design.

Less overheating takes place, with resultant longer buff life and, of course, reduction of the fire hazard. It enables the use of increased pressures and dwell time.

The pre-assembled, interlocking characteristics result in faster changeover, and less machine downtime, due to ease of loading and unloading. There is superior compound head retention, even when the wheel is removed from the shaft, set aside, and replaced at a later date.

As a belt contact wheel, the centerless buff is excellent for the above reasons, and also because of non-slip and non-spin characteristics. Special centerless buffs are used as polishing wheels, the main advantage being the possibility of adding or removing buff sections, thus widening, narrowing and changing the contour of the wheel.

Polishing wheels are normally made of buff sections glued together. Centerless polishing wheel sections require no glue, achieving a more uniform density. The lack of glue between buff sections also allows for softer wheels with better part coverage. Hence, fewer wheels are needed for the part to be finished.

A corollary benefit of the centerless buff is that the flange which holds the buff on the shaft is virtually indestructible. This is caused by the domed shape and locking-in design. The flange may be inverted and used on any type of buff. A special flange is available which allows one to buff the inside of a cylinder, such as a pot, or light reflector, by recessing the shaft and retaining nut entirely within the buffing wheel.

A centerless wheel will fit any size shaft up to and including the inside diameter of the wheel itself. This is usually seven inches. In shops where various size shafts are in use, it may otherwise be necessary to carry inventory of each type buff for each size shaft. The centerless fits all size shafts.

Buff Treatments

Buffs may be treated with substances to increase lubrication, cloth strength, buff body, and compound retention, but the treatment must not leave a film on the work. Since some will possibly be retained by the part, it must easily be cleaned by the process in use by the specific plant. It must not interfere with a subsequent plating operation. Buffs may be treated to raise the kindling point, or to flameproof them entirely. However, there is little danger of fire with properly ventilated and properly constructed and treated centerless or steel center buffs. Therefore, the cost of flameproofing usually is not warranted when weighed against the additional buff life and compound retention imparted by other treatments which are also partially fire retardant. Various chemicals have been applied to buff material before assembly, and also to finished buffs.

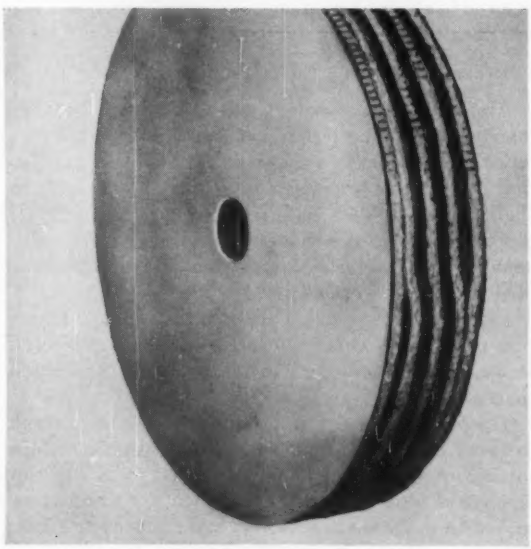
The purpose of the treatments may be to harden for additional cut, to soften for additional flexibility, to strengthen for longer buff life, to lubricate to prevent burning, to adhere for retention of buffing compound, to abrade for heavier cut, to flameproof to raise kindling point or completely prevent fire. Treatment alone is not enough. The treatment must be basically sound and suited to the job.

The treatments should be applied evenly and uniformly, avoiding hard spots and imbalance. Treatment must not deteriorate rapidly with age. Some treatments actually weaken the cloth, resulting in decreased buff life.

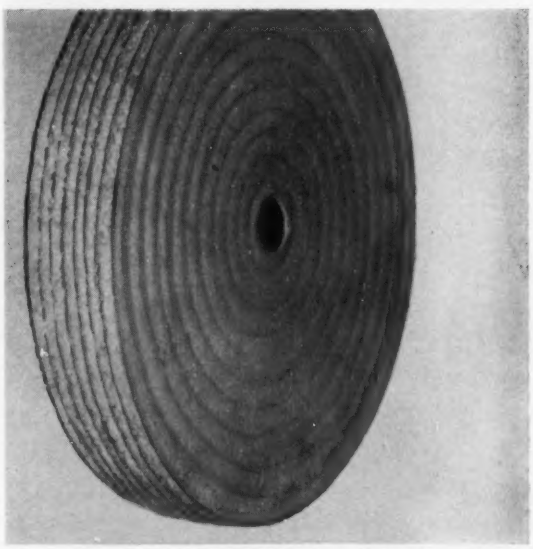
Sisal Buffs

Sisal is a long, coarse fiber that is twisted into strands and frequently woven into a fabric. It has a much lower thread count than cotton cloth, often in the neighborhood of five strands by seven strands per inch. It took some time for the industry to learn how to use sisal buffs, and for the buffing compound manufacturers to develop compounds to bring out its important advantages of toughness, great structural strength, and resistance to deterioration by buffing compounds.

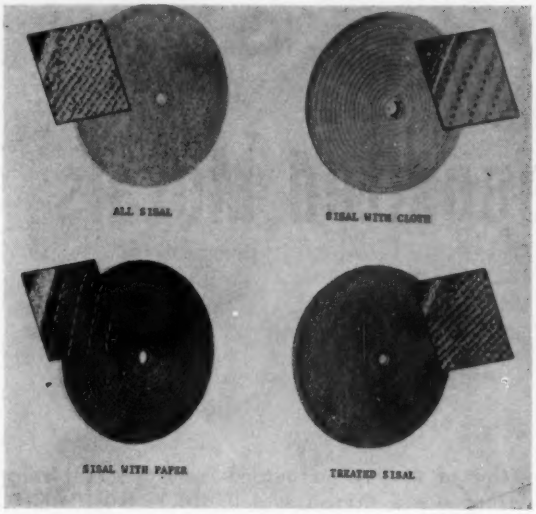
Cloth covers frequently have been used, as sisal has a tendency to cut the cotton threads of adjacent buffs. Cloth is used sometimes in the interior of the buffs to provide a better base for the stitching and to improve compound retention and reduce unraveling. Krinkle kraft paper is used with sisal to increase cut. The equipment used to pucker cloth buffs was adapted to sisal buffs and had the same advantages that puckered cloth buffs have over conventioned buffs. The advantages of puckered sisal over conventional sisal buffs are even greater, however, due to the low count, coarse weave of sisal. Fray is reduced tremendously. To further reduce the tendency to fray, special sisal treatments have been developed that help to bind the fibers to-



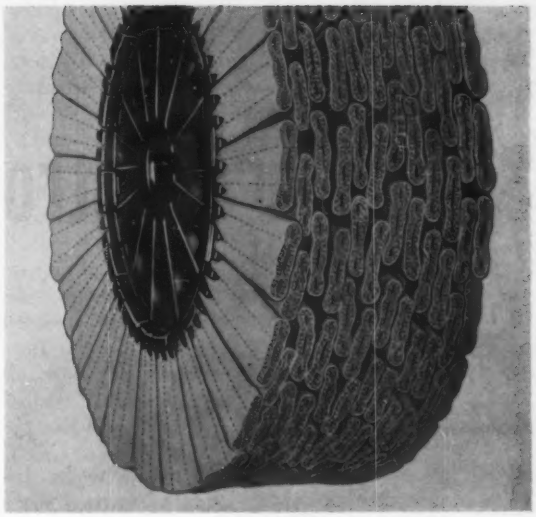
Non-ridge polishing wheel.



Cloth sectional polishing wheel.



Sisal buffs.



Unit sisal buffs.

gether. A flat puckered sisal buff has been developed for jobs requiring a hard sisal buff. Hard treatments have added even more cut, and sisal has taken the place of some finer polishing operations and many deburring and brushing operations.

The bare metal process (buffing of steel followed by copper, nickel, and chromium plating) resulted in an increase in the use of sisal. Tapered, puckered sisal (wider at outside diameter than at inside diameter) was introduced to eliminate gaps between these hard sections and streaking of the work.

As steel and stainless steel parts increased in contour complexity, softer treatments, wider sewing, and spacers were used. This was not enough, however, and two ingenious products were developed to fill the need.

The unit sisal, or spoke sisal, which consists of woven sisal covered and interlaced with 86/93 cloth is manufactured in endless belts and bound by rows of sewings into individual spokes, or units, puckered, doubled, and held by steel teeth. The open cloth puckered sisal (OCPS), which consists of woven sisal and 86/93 cloth bound together by concentric sewing, is manufactured in endless strips and rolled several times, puckered, doubled, and held by steel teeth. Variations of the OCPS buff are open puckered sisal (OPS), consisting of two layers of sisal, bound together by sewing, and open double cloth puckered sisal (ODCPS), consisting of two rows of cloth, bound by sewing to one layer of sisal. These designs give truly flexible sisal buffs for use on contoured steel and stainless steel parts.

(To be concluded next month)

FINISHING AIRCRAFT

(Concluded from page 50)

Manufacturing Methods

Due to the numerous and diversified types of manufacturing operations involved in the painting of aircraft, it is essential that systematic methods be established. It was clearly demonstrated during this program that both cost and quality benefited by specialization of skills and a systematic and consistent sequence of operations. After careful study of the process variables involved, the facility and man-power capabilities, and production schedule requirements, the following sequence of operations was established:

Day	*Shift*	*Operation*
1st	1st	(1) Preclean
	2nd	(2) Steam Clean
		(3) Apply Surface Treatment
2nd	1st	(4) Apply Paint
	2nd	(5) Apply Markings
3rd	1st	(6) Apply Stencils
		(7) Touch-up
		(8) Final Inspection

The elapsed time, 56 hours, for the above operations is compatible with current production schedules. In event of accelerated production rates, it is anticipated that this elapsed time could be reduced to approximately 44 hours by addition of a third shift.

Cost Savings

All process, material and method improvements ultimately resulted in cost savings to the company. The Engineering Department contributed by investigating and developing more reliable and less expensive materials and processes. The Manufacturing Department contributed by revising methods and sequence of operations, establishing special skills and training requirements where applicable, and stressing quality workmanship. The Quality Control Department contributed by reducing rework through materials and in-process controls, and developing test procedures compatible with production operations. The savings accumulated from all these sources exceeded $100,000 for the year of 1959. Materials, processes and methods with cost saving potential are continuously being investigated and evalutated.

Stress in Electrodeposited Metals

By I. Laird Newell, *The Henry Souther Engineering Co., Hartford, Conn.*

THE stress in electrodeposited metals to be discussed in this paper is the so-called internal stress or residual stress produced in the plating process. The stress is considered tensile when the internal forces tend to cause the deposit to contract. The stress is compressive when the tendency is for the deposit to expand. The magnitude of these forces will be limited by the modulus of elasticity and elastic strength of the metal.

Table 1 gives the modulus of elasticity and tensile strength of some of the more common electrodeposited metals and of steel.

It is obvious that, if a metal is deposited on one side of a thin, flat metal sheet, the sheet will remain flat if no internal stress results in the deposited metal. However, if a tensile stress is present in the deposited metal, the plated surface will tend to shrink and become concave. On the other hand, an internal compressive stress will cause the sheet to become convex.

Since the degree of bending is a function of the elastic modulus, which is the ratio of stress to strain, it is possible to calculate the magnitude of the stress from the deformation observed.

Measurement of Residual Stress

Several methods and instruments have been developed to determine the stress in electrodeposits, and all depend on measuring the deformation resulting from plating on one surface of a relatively thin elastic basis metal.

TABLE 1

Metal	*Modulus of Elasticity*	*Tensile Strength —psi (pure cast)*
Cadmium	8,000,000 psi (not well defined)	10,000
Chromium	36,000,000	80,000
Copper	16,000,000	32,000
Nickel	30,000,000	80,000 to more than 150,000
Zinc	14,000,000 (not well defined)	10,000
Steel	30,000,000	60,000 to more than 150,000

One of the earliest methods consisted of plating on one side a strip of steel 0.010″ to 0.015″ thick, about 0.50″ wide, and 6″ long and observing the deflection as the strip was plated. A more accurate measurement was obtained by clamping the piece in a plating fixture to stop off the back, ends, and sides of the strip, as well as to shield the edges. The strip was held flat during plating and the deflection measured after removal from the fixture.

$$\text{Residual Stress "S"} = \frac{4\,E\,(t + t^1)^3\,d}{3\,L^2\,t\,t^1}$$

where "S" = stress in psi
E = Modulus of elasticity of test strip
t = Thickness of strip in inches
t^1 = Thickness of deposit in inches
d = Measured height of curvature in inches
L = Length of chord in inches

Details of this method are given in papers by Phillips and Clifton,[1] Soderberg and Graham,[2] and Stareck, Seyb and Tulumello.[3]

PARATOLUENE SULFONAMIDE
EFFECT OF CURRENT DENSITY ON STRESS AND HARDNESS AT 90° F.

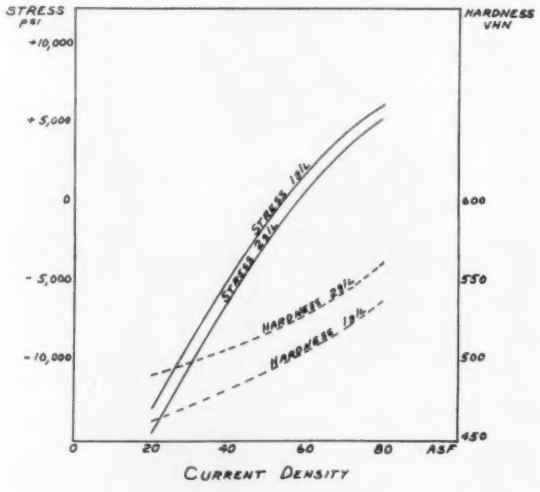


Figure 1

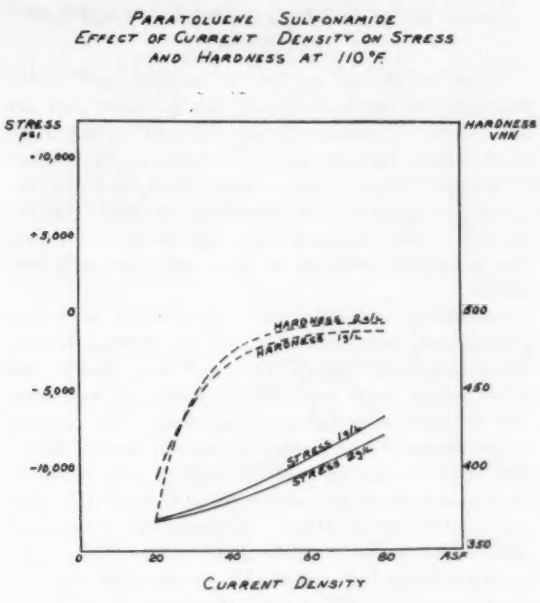


Figure 2

A commercially available instrument for measuring stress in electrodeposits has the advantage of indicating the degree of stress at any time while electrodeposition is taking place. This instrument, known as the Spiral Contractometer, was developed by Brenner and Senderoff of the National Bureau of Standards.[4] A thin metal strip about 0.75″ wide and 0.010″ to 0.015″ thick is wound in the form of a helix with one end fixed, the other attached to the needle of a dial to measure angular deflection. Tensile stresses will cause an unwinding of the helix and compressive stresses a tightening of the helix when the inside is stopped off.

$$\text{Residual Stress "S"} = \frac{d}{8\,D\,p\,t\,t^1}$$

where "S" = stress in psi
- d = degrees deflection due to stress in deposit
- D = degrees deflection with 1 oz. calibrating weight
- p = pitch of helix in inches
- t = basis metal thickness in inches
- t^1 = plate thickness in inches

Another instrument for measuring stress during plating is known as a Stresometer and was developed by Kushner.[5] A thin flat metal disc is clamped in place to form the cover of a shallow chamber filled with a metering fluid. When the flat disc is plated with a metal having a residual tensile stress, some of the fluid is squeezed from the chamber into a capillary tube and the amount measured. From the volume displaced, the stress can be calculated.

Effect of Stress on Properties and Uses of Electrodeposits

One of the most important factors in electroforming precision parts is residual stress. Where accurately sized parts, such as venturi tubes, are electroformed, neither tensile nor compressive stresses can be tolerated. Large numbers of electronic parts are now electroformed, and zero stress is in most cases desirable in order to prevent deformation.

Parts of machines which are subject to repeated stress, and which require electrodeposits for protection, can often be given a higher endurance limit by means of a compressively stressed electrodeposit. Since the endurance limit of a part, in general, depends on the strength, surface quality, and stress in the outer fiber, a compressively stressed, high-strength, smooth surface is desirable.

A deposit with a residual tensile stress will tend to crack and peel from a surface when there is poor adhesion, whereas, a zero or slightly compressive deposit would not tend to peel even though the adhesion were poor.

In the case of chromium, the high tensile stresses from certain baths cause cracks, sometimes hundreds per square inch.

Cadmium plate, which is usually deposited with a compressive stress, may form blisters when the adhesion is poor, due to the tendency to expand.

Electrotyping requires a low residual stress deposit in order not to deform the molds.

There is also some indication that residual stress is a factor in the corrosion resistance of plated metals. It is well known that, in a non-uniformly stressed part, the highly stressed area is anodic.

Plating on plastics and rubber will require a zero stress in the coating in most cases.

Theory of Stress in Electrodeposition

While it is beyond the scope of this paper to discuss the various theories of stress formation in electrodeposits, it is agreed that the stress is due to defects in the crystal lattice of the metal. Several factors appear to influence these defects, including the basis metal and its preparation, as well as impurities and additives to the baths which are co-deposited with the metal. Temperature, current density, and metal thickness are also influential in many cases.

A review of the theories and factors affecting residual stress has been given by Kushner[13] who found contaminants, addition agents, deposit thickness, bath composition, metal surface, grain size, temperature, and current density to be critical. Very low temperatures cause low cathode efficiency, and low current densities cause high tensile stress. The larger the grain size the further the region of maximum stress is moved from the interface and into the deposit. For similar type crystal structures, lattice parameters affect the interfacial stress. Nickel, with a smaller lattice parameter than copper, is in tensile stress on copper but copper is compressive on nickel.

Stress in Electrodeposited Copper

The internal or residual stress in electrodeposited copper is of importance because of the use of copper as an undercoat for other deposits, as well as for electrotyping and electroforming.

The internal stress in copper from a standard Rochelle-cyanide bath operated at pH 12.5; tem-

perature 158°F., and current density 20 amp./ft.^{2} was reported by Graham and Lloyd[6] to be tensile at 8,700 lbs./in.^{2} Changes in current density caused changes in the stress related to changes in current efficiency. Changes in bath composition caused changes in stress not related to efficiency. Addition of 75 parts per million of lead increased the tensile stress to 15,400 psi, whereas, the addition of 15 g./l. potassium thiocyanate changed the stress to compressive in the order of —4,000 psi. Periodic reverse plating from the standard bath gave high tensile values, in the order of 11,000 psi.

Residual stress in copper electrodeposited from acid baths has been the subject of a number of investigators. Van der Sommen[7] reported that the stress is compressive on copper but generally tensile on other basis metals. Zinc impurity caused a compressive stress. Shibasaki[8] found that higher current densities and lower temperatures gave greater residual stress. Fedot'ev and Kruglova[9] investigated a number of additives for controlling stress including disulfonaphthalene, phenol, formalin, dextrin and phenol, and sodium potassium tartarate (Rochelle Salt). Vagramyan and Tsareva[11] found that naphthalene disulfonic acid lowered the stress in copper deposits.

Only Rochelle Salt gave a residual compressive stress in the deposit. The use of invert sugar, dextrin, or the presence of iron, nitrates, or ammonia salts does not appear to alter the stress in the presence of Rochelle Salts. Small amounts of chloride (0.0004 g./l.) cause a tensile stress of about 500 psi compared with —5,000 psi without chloride. Increasing current density and acidity lower the residual compressive stress.

Since both the modulus and tensile strength of copper are low compared to steel, no problems would be encountered with steel basis metal, but they are high compared to zinc and might cause structural problems if the copper were highly stressed. More work should be done on control of stress in copper plating baths.

Stress in Electrodeposited Zinc, Lead and Cadmium

These metals are so low in strength and elastic modulus that internal stresses, for the most part are unimportant. However, the stresses may be important when factors such as poor adhesion may be present. Hothersall[10] found that cadmium, lead, and zinc deposits are generally compressively stressed and the stress for zinc increases after deposition is finished. The magnitude and type of stress may vary with conditions.

Gorbunova and Popova[12] investigated acid zinc plating baths and found relatively low internal stresses. When aluminum sulfate was used as a buffer, the stress varied from only 284 to 1700 psi, and from 700 to 1400 when glucose was used. The internal stress increased with increasing current density. Kushner[5] reported that an acid zinc sulfate bath showed a compressive stress of —8,000 psi at 0.0001″ thickness and —3,000 psi at 0.0007″ thickness. We have noted compressive stress in an acid zinc plate from a glucose-containing bath where the stresses were very low — less than —1,000 psi on thickness of 0.0005 to 0.001″.

Cadmium deposited from a standard cyanide bath without a brightener shows a compressive stress usually not over —1,000 psi.

Stress in Electrodeposited Chromium

Tensile stresses in chromium plate have been noted in the literature from time to time. In particular, Brenner, Burkhead and Jennings[14] and Stareck, Seyb and Tulumello[3] have reported comprehensive studies of chromium plate. The former determined the stresses by means of a spiral contractometer and found that, at bath temperatures of 115°F. and 122°F., a high stress is present in thin deposits, which rapidly decreases as the thickness increases. This is explained by cracking of the plate at critical thicknesses, which

PARATOLUENE SULFONAMIDE
EFFECT OF CURRENT DENSITY ON STRESS AND HARDNESS AT 130°F.

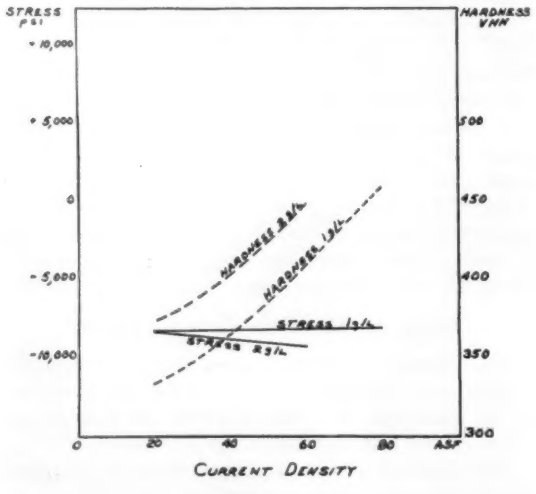


Figure 3

SACCHARIN
EFFECT OF CURRENT DENSITY ON STRESS AND HARDNESS AT 70°F.

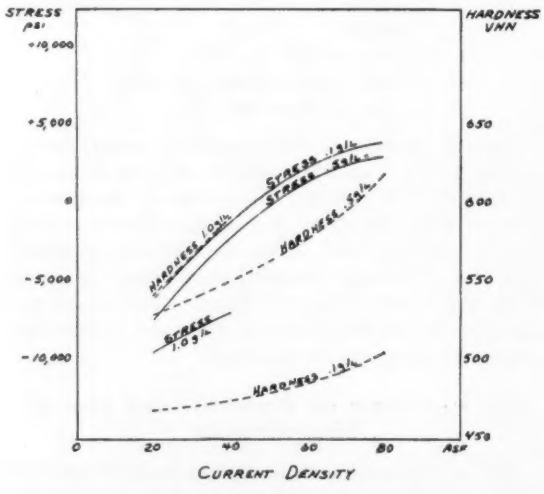


Figure 4

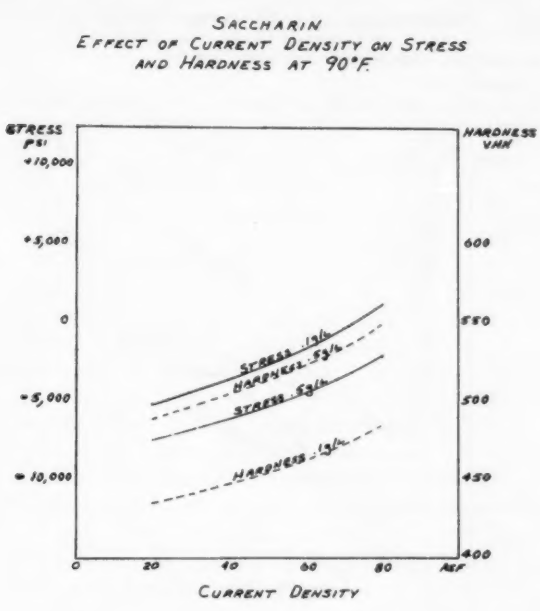


Figure 5

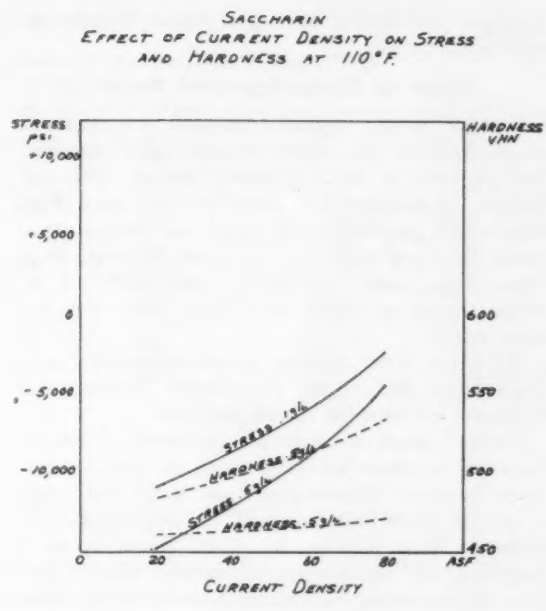


Figure 6

relieves the stress. It is noted that, at 115°F., coatings thinner than 0.00002" do not contain cracks, but deposits greater than 0.00005" have cracks. The high tensile stress of +80,000 psi found in the thin deposits is equal to the tensile strength of the chromium, and accounts for the cracking. With thicker deposits, the stress approaches 17,000 psi. Deposits made from baths at temperatures as high as 185°F. did not develop as high a tensile stress and did not tend to crack. Residual stresses in the order of 64,000 psi were found.

Stareck and his co-workers made an exhaustive study of some commercial chromium plating baths and confirmed the previous observations that stress is high in thin deposits but drops rapidly after a critical thickness is reached. At 150°F., in an ordinary plating bath, the stress becomes constant at about 0.002" thickness. At lower temperatures, lower residual stresses are encountered on thick deposits and, at 110°F., a compressive stress is found at greater than 0.003" thickness.

In a proprietary bath, a compressive stress was found in thicknesses greater than 0.002" when plated at 130°F., despite the fact that the initial thin plate stresses were more than 100,000 psi in tension. The change from tensile to compressive forces is believed to be the result of crystal growth in the cracks, which have relieved the tension. Table 2 gives data on residual stress and cracks presented by Stareck. The results show a relationship between the stress and cracks.

It is apparent that, in chromium deposits, stress changes with thickness until a crack pattern is established. The magnitude of the stress is a function of the crack pattern, and numerous cracks result in low stress. Compressively stressed chromium can be obtained with baths which produce a large number of fine cracks. Stareck found a lower stress when chromium was deposited on copper rather than steel and was believed to be the result of the weaker metal allowing a more rapid crack pattern. Somewhat lower stress values were also obtained when measuring the stress with the rigid, flat strip method rather than the spiral contractometer. The movement and bending of the spiral during plating is said to allow stress relief. Baking the deposit up to 350°F. increases the stress by shrinkage, due to loss of

TABLE 2

Correlation between Cracks and Stress

Bath	*Plating Conditions*	*Stress (2 mil thickness)*	*Cracks per inch*
Proprietary, 180 g./l.	110°F., 1 amp./in.^{2}	—17,000 psi	3,500
Proprietary 225 g./l.	130°F., 2 "	— 3,000	1,300
CrO_3-250 g./l.	110°F., 1 "	+ 3,000	1,200
SO_4-2.5 g./l.			
CrO_3-250 g./l.	130°F., 2 "	40,000	400
SO_4-2.5 g./l.			
CrO_3-250 g./l.	150°F., 2.9 "	47,000	50
SO_4-2.5 g./l.			
Proprietary, 315 g./l.	140°F., 3 "	60,000	22

hydrogen, but further heating at higher temperature reduces the stress.

Stress in Electrodeposited Nickel

Because of the desirable physical properties of nickel, such as high tensile strength, good ductility, and modulus of elasticity about that of steel, and because of its corrosion resistance and good high temperature properties, this metal has become more useful than any other for structural deposits. As a consequence, more investigation and study of internal stresses in nickel have taken place than for other metals.

While the Watts solution is most commonly used, other baths such as the all chloride, fluoride, and sulfamate are used for special purposes.

Martin[15] made a comprehensive study of the effects of variables and impurities on the residual stress in nickel electrodeposits and found that, when a low pH Watts bath was used, the concentration of nickel or boric acid has no effect. Tensile stress is increased by an increase in current density and chloride concentration, but is reduced by increased temperature. The stress decreases slightly with increased pH up to 4.0 to 4.5, then increases rapidly above 5.0. With higher chloride concentration, increased stress is shown at lower pH values. In low concentration, lead, zinc, and chromium have little effect on the stress. It has been found desirable to keep the lead and zinc below 0.002 g./l. maximum and the hexavalent chromium less than 0.003 g./l. Copper should also be kept below 0.003 g./l.

Iron and aluminum both increase the stress and should be kept as low as possible. Martin also showed that certain organic acids such as formic, citric and acetic decrease the stress in the electrodeposits. Curkin and Moeller,[16] in a study of the effect of iron on a Watts bath, found a relationship between the amount of iron, residual stress, and endurance limit. Table 3 gives the composition of the bath and results obtained, and indicates an increase in residual stress of about 50% with 0.2 g./l. iron when compared to an iron-free bath.

NAPHTHALENE 1,3,6 TRISULFONIC ACID
EFFECT OF CURENT DENSITY ON STRESS
AND HARDNESS AT 90°F

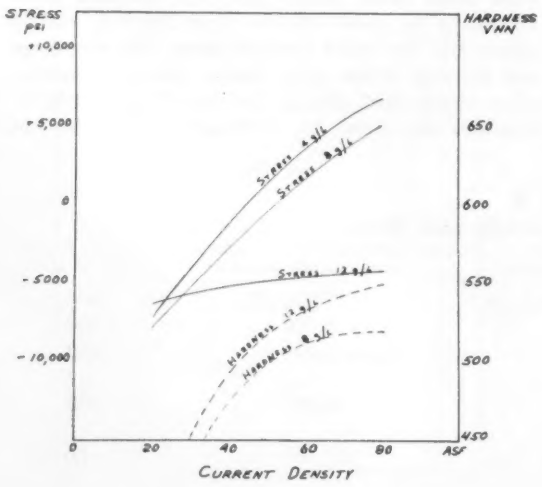


Figure 7

NAPHTHALENE 1,3,6 TRISULFONIC ACID
EFFECT OF CURRENT DENSITY ON STRESS
AND HARDNESS AT 110°F

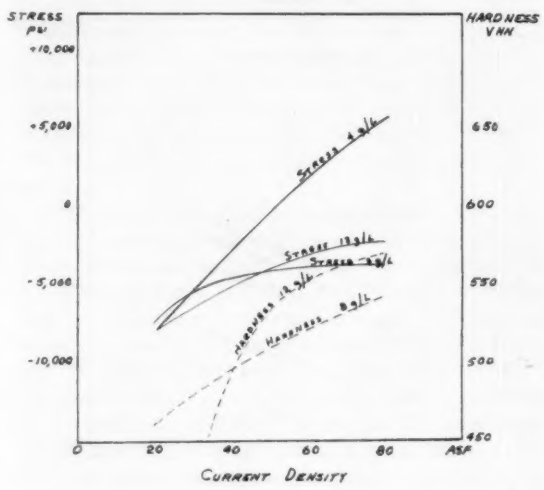


Figure 8

TABLE 3

Watts Bath (purified)

Nickel metal	8-10 oz./gal.
Chloride	4.0 - 6.5 oz./gal.
Boric acid	3.5 - 4.5 "
pH	1.8 - 2.0
Temperature	120 ± 5°F.

Iron	Endurance Limit	Residual Tensile Stress
None	71,200 psi.	18,500 psi
0.2 g./l.	61,300	27,500
0.4 g./l.	55,200	39,500
Unplated Steel	86,400	—

Phillips and Clifton[17] confirmed some of the work of Martin and also found that 2 grams per liter of iron quadrupled the residual stress. Soderberg and Graham[2] determined the stress in all-sulfate, chloride, and fluoborate baths, the latter containing saccharin. Table 4 shows the results of this study and indicates that a hard deposit is not necessarily highly stressed, and that a soft deposit may be substantially tensile in stress. There seems to be no relationship between hardness and stress.

Kushner[5] found nickel from an impure Watts bath:

$NiSO_4 \cdot 7H_2O$	32 oz./gal.
$NiCl_2 \cdot 6H_2O$	6 "
H_3BO_3	4 "

to have a residual tensile stress of 24,000 psi when plated on copper or steel to a thickness of 0.0005" at 20-25°C. The same bath when purified gave a stress of 19,500 psi tensile on copper at a thickness of

TABLE 4

Comparative Stress and Hardness in Nickel Deposits from Baths 2.5 N in Nickel; 0.5 M H_3BO_3

Bath No.	Bath Type	C.D. amp./ft.²	110°F. Stress, 1000 psi	110°F. Hardness, Knoop	160°F. Stress, 1000 psi	160°F. Hardness, Knoop
1	All-sulfate	20	16.4	335	19.6	326
	"	50	18.3	307	19.6	319
	"	100			20.7	274
6	All-chloride	20	29.6	327	26.3	286
	"	50	41.4	289	33.6	286
	"	100			38.0	287
12	Fluoborate	50	—3.2	466	—1.3	329
	"	100	—2.0	536	0.0	359
	"	150			—1.2	482

Note: Bath No. 1 — pH 3.4, no additions.
" " 6 — pH 3.5, no additions.
" " 12 — pH 3.0 colorimetric, saccharin.

0.00017" and 29°C., and on steel 18,900 psi at a thickness of 0.00045" and 27°C.

Marchese,[18] in an investigation of nickel baths for electroforming microwave conductors, concluded that stress in a Watts bath deposit could be made compressive by use of saccharin, but gave erratic results and was difficult to control. Superimposing alternating current on direct current at a ratio of a-c peak voltage to d-c voltage of 3 to 1 and bath pH of 4.5 gave tensile stresses as low as 2,500 psi when 60-cycle current was used. Hydrogen peroxide increased the stress in deposits and a wetting agent was suggested for use as an anti-pit agent.

The stress in sulfamate baths has been investigated by the author,[19] and it was found that a purified bath without the use of addition agents produced a lower residual tensile stress than the Watts bath. However, the effectiveness of certain organic addition agents, such as sodium naphthalene trisulphonate,[10] saccharin,[2], paratoluene sulphonamide,[19] and orthoformyl benzene disulfonic acid[20] make nearly all types of nickel plating baths suitable for producing zero or compressively stressed nickel. It is believed that these agents co-deposit with the nickel, as they are used up during the plating process. The stress obtained is not uniform over a wide current density range, and some improvement in this respect is necessary. It seems likely that further research on the use of organic addition agents will be fruitful in the field of stress control.

NAPHTHALENE 1,3,6 TRISULFONIC ACID
EFFECT OF CURRENT DENSITY ON STRESS
AND HARDNESS AT 130°F

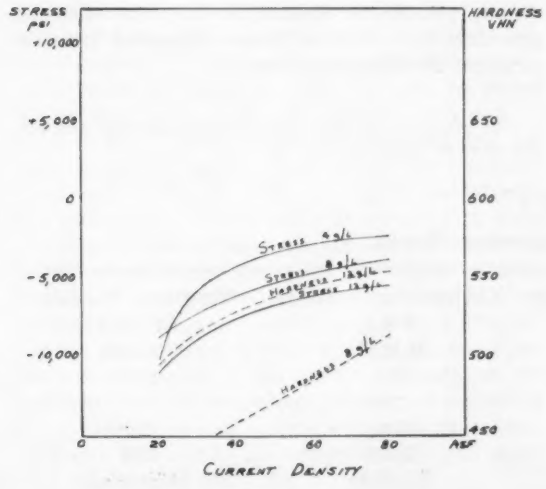
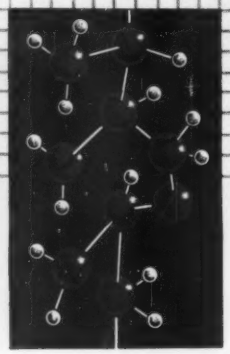


Figure 9

References

1. W. Phillips and F. Clifton, Proc. Am. Electropl. Soc., **34**, 97 (1947).
2. K. Gustav Soderberg and A. Kenneth Graham, Proc. Am. Electropl. Soc., **34**, 74 (1947).
3. J. E. Stareck, E. J. Seyb and A. C. Tulumello, Proc. Am. Electropl. Soc., **41**, 209 (1954).
4. A. Brenner and S. Senderoff, J. Res. Nat. Bur. Standards, **42**, 89 (1949).
5. Joseph B. Kushner, Proc. Am. Electropl. Soc., **41**, 188 (1954).
6. A. K. Graham and Robert Lloyd, Plating, **35**, 449 (1948).
7. J. Van der Sommen, Proc. Third International Electrodep. Conf., p. 95 (1947).
8. Yasuichi Shibasaki, J. Electrochem. Soc. Japan, **19**, 82 (1951).
9. N. P. Fedot'ev and E. G. Kruglova, J. Appl. Chem. (USSR), **28**, 251 (1955).
10. A. W. Hothersall, J. Inst. Metals, Symp. on Stresses in Metals (1947).
11. A. T. Vagramyan and Yu. S. Tsareva, Zhur. Fiz. Khim, **29**, 185 (1955).
12. K. M. Gorbunova and O. S. Popova, Zhur. Fiz. Khim, **30**, 269 (1956).
13. J. B. Kushner, Metal Finishing, **56**, #5-82; #6-56; #7-52 (1958).
14. Abner Brenner, Polly Burkhead and Chas. W. Jennings, Proc. Am. Electropl. Soc., **34**, 32 (1947).
15. Bernard Martin, Proc. Am. Electropl. Soc., **31**, 206 (1944).
16. L. H. Curkin and R. W. Moeller, Proc. Am. Electropl. Soc., **41**, 196 (1954).
17. W. M. Phillips and F. L. Clifton, Proc. Am. Electropl. Soc., **34**, 97 (1947).
18. Vincent J. Marchese, J. Electrochem. Soc., **99**, 39 (1952).
19. I. I. Newell, Proc. Am. Electropl. Soc., **43**, 101 (1956).
20. Dodd S. Carr, U. S. Patent 2,842,487.



SYNTHETIC RESINS

The Backbone of Modern Finishes

A SURVEY OF THE LATEST DEVELOPMENTS IN SYNTHETIC RESINS USED IN COATINGS

Part V - Fluorocarbon Resins

By Harold P. Preuss

THIS family of resins, as used in surface coatings for application on metallic substrates, consists of three main types, namely, polytetrafluoroethylene, chlorotrifluoroethylene and vinylidene fluoride. All of these fall under Classification No. 2 (Chlorine or Fluorine Containing Polymeric Hydrocarbons) mentioned in the first article in this series. Polytetrafluoroethylene is commonly known as "Teflon," whereas chlorotrifluoroethylene is marketed under the name "Kel-F". They are very close relatives of each other.

Table I lists some of the properties of three types of resins. Their chemical resistance is excellent. All are expensive.

Polytetrafluoroethylene

Polytetrafluoroethylene was discovered in 1938 as a result of laboratory research on a family of "Freon" refrigerant compounds consisting of fluorine, carbon and chlorine. This chemical, known as "Teflon" in the United States and "Fluon" in England, is manufactured by E. I. DuPont de Nemours & Co., Inc., Wilmington, Del. It is a completely fluorinated compound. Its commercial production was commenced in 1941 and the first large scale plant began operations in 1950.

The starting material for the manufacture of polytetrafluoroethylene is chloroform. Monochlorodifluoromethane is first formed by liquid-phase hydrofluorination of chloroform, as follows:

$$CHCl_3 + HF \xrightarrow[65°C]{SbCl_5} CHFCl_2 + CHF_2Cl + CF_2Cl_2 + HCl$$
$$\downarrow AlCl_3$$
$$CHF_2Cl + CHCl_3$$

The monomer of tetrafluoroethylene is next made by pyrolysis.*

$$2CHF_2Cl \xrightarrow{650°–800°C} CF_2{:}CF_2 + 2HCl$$

This is a colorless, odorless gas which liquifies at —76°C. Polymerization is accomplished at high pressure and temperature using oxygen and organic peroxides as the initiator.

"Teflon" fluorocarbon resin finishes are usually dispersions in essentially a water medium. Recommended coating systems based on "Teflon" formulated to protect metals from corrosion, for heat resistance, and for antisticking applications are essentially the same. However, certain differences in precautions taken during application and in film thickness are necessary in order to do the best job with the least amount of material.

Properties of "Teflon" Finishes

"Teflon" finishes have excellent anti-sticking properties. However, it is not quite correct to say that nothing will stick to "Teflon." There are a few materials of an unusually tacky nature which possess varying degrees of adhesion to "Teflon". In the few cases where sticking trouble is encountered, it is frequently possible to eliminate it by proper cleaning procedure, the choice of cleaner depending upon the nature of the adhering product.

*The process of breaking down complex materials into simpler units by means of heat.

TABLE I

Properties of Fluorocarbon Resins

Type resin	Polytetrafluoroethylene	Chlorotrifluoroethylene	Vinylidene Fluoride
Trade name	Teflon	Kel-F	RC-2525
Manufacturer	DuPont	M.M.M.	Pennsalt
Specific Gravity	2.15	2.1	1.76
Dielectric Strength, v. per mil	500	460	—
Effect of Sunlight	None	None	Nil
% Water Absorption, 24 hrs.	0.005	0.001	0.04
Resistance to Acids and Alkalies	Excellent	Excellent	Very good

Systems based on "Teflon" for heat resistance are similar in every respect to those for anti-sticking uses except that, if desired, thinner films may be applied. Such films appear to be stable indefinitely at 250°C. (482°F.). In some instances, good performance has been obtained over long periods at 275°C. (527°F.) and at 300°C.(572°F.) for shorter times.

"Teflon" resin is completely inert to all chemicals and solutions of chemicals up to their boiling points, with the exception of molten alkali metals, and fluorine and chlorine trifluoride under special conditions. Accordingly one would expect "Teflon" finishes to give excellent performance against chemical exposures. "Teflon" coatings, however, usually give poor performance on exposure to hot (200°F.) nitric and hydrochloric acids, particularly in the vapor phases, and to certain other corrosive chemical solutions.

This effect is observed even though no visible pinholes exist, and even where a great multiplicity of coats is applied. One theory is that the acids, or their hydrogen ions, are able to find their way through the molecular structure itself, and attack the basis metal. Another theory is that microscopic pores are formed in the film during the release of the water.

In many cases, however, good performance can be obtained under very difficult conditions. In one case, steel panels were primed and coated with five applications of a "Teflon" clear finish. After 1540 hours exposure to 20% hydrochloric acid and 20% nitric acid at room temperature no change was noted in the films and no corrosion of the surface had developed. Exposure for over 1000 hours at 200°F. to 73% caustic soda solution, 95% sulfuric acid, and toluol showed no effect. Other chemicals that have been found to have no effect on "Teflon" coatings include: phenothiazine, diphenylamine, hydrogen-sulfide, ammonium sulfate, sulfur vapor, diethylene glycol, sulfonated oils, sulfated higher alcohols, terpenes, and aromatic and aliphatic hydrocarbons.

In protecting a corrodible substrate the degree of protection afforded by a thin film is dependent not only upon the chemical stability of the film itself, but upon its impermeability to corrosive materials. Although this resin is chemically inert, relatively thick films laid down in multiple coats are required to prevent pinholing, and to achieve impermeability to corrosive vapors. For best corrosion resistance, priming coats should be limited to about 0.3 mil, the use of intermediate coats should be avoided, and 4 to 6 coats of the "Teflon" finish, approximately one mil each, should be applied. Coats should be separately fused, and all but the final coat lightly sanded with fine sandpaper or emery paper to remove high spots and dust. For short time exposure and for less severe corrosive conditions, fewer topcoats might be satisfactory but not less than three are recommended. Both sanding and buffing are known to anneal the "Teflon" systems and produce tougher and less porous films. Since contamination of the surface by sandpaper adhesive or other residue reduces adhesion of succeeding coats, wipe the sanded surface with clean rags saturated with xylene (do not use tack-rags) and apply blast of clean dry air.

A "Teflon" coated surface is relatively soft and waxy, and would be expected to have low abrasion resistance. However, it has an extremely low coefficient of friction and can be considered as self-lubricating. Unless, therefore, the surface is physically damaged by contact with hard or sharp objects it may last a very long time indeed under constant or intermittent wearing action. For example, a "Teflon" coating was applied to a dough chute in a bakery, handling 2,500,000 dough pieces per month. There was no apparent wear after 7 months of exposure. On the other hand, certain equipment in contact with wet sand showed failure in a matter of minutes.

Successful Applications

"Teflon" finishes have been used in a wide variety of successful applications. Table II lists just a few.

Methods of Application

The basic finishing procedure for "Teflon" coatings is as follows:

(a) Prepare and clean surface
(b) Apply 0.2 to 0.4 mil of "Teflon" primer (dry film basis) by spray
(c) Air-dry (or oven-dry below 200°F.) until medium brown in color
(d) Bake at 750°F. until sintered (except for copper and copper alloys)
(e) Apply Enamel or Clear Finish by spray
(f) Air-dry (or oven-dry below 200°F.) until water is evaporated
(g) Bake at 750°F. until sintered
(h) Repeat e, f, and g as desired

Finishes based on "Teflon" may also be applied

TABLE II

Typical Applications of "Teflon" Finishes

Agitator paddles	Metal spray shields
Baffle plates	Molding dies
Bearings	Oven conveyors
Calender end plates	Packaging equipment
Casting wheels	Pails
Centrifugal pumps	Paint mixers and drums
Conveyor chutes	Paper making machinery
Conveyor tubes	Pipe interiors
Doctor blades	Plastic molding forms
Drum driers	Pressing plates
Dry ice platens	Reels
Dump valves	Roller mill end plates
Dye vats	Rubber boot lasts
Feed hoppers	Rubber molds
Filling equipment	Rupture discs
Floor tile molds	Scale platforms
Funnels	Size boxes
Glue dispensers	Snow plow blades
Gluing machines	Soap dies
Heat sealing units	Spark plugs
Ignition contact molds	Still explosion plates
Ladles	Storage bins
Laminating platens	Textile drying cans
Mandrels	

by dip or flow coating, or by brush coating. Complete curing of "Teflon" coatings is indicated by a color change in the film.

Recently "Teflon" became available in a powdered form suitable for use in fluidized bed applications. In this form it is known as *"Teflon" 100 FEP fluorocarbon resin.* Prior to application, substrate surfaces must undergo sandblasting and solvent cleaning operations. The part being clad should be oven heated to a surface temperature of 650°F. or higher. After 1 to 2 second dip in the fluidized bed, followed by low pressure airblasting to remove excess powder, a return trip to the oven for 20 minutes of additional heating fuses the resin into a continuous 2-mil film. Subsequent dips add about 1½ to 2½ mils of film for each dip. Maximum permissible film thickness has been found to be roughly 15 to 17 mils.

"Teflon" finishes are acidic, and should be stored in stainless steel, polyethylene, glass, or "Teflon" finished containers. Aluminum alloy spray guns may be used for intermittent application without abnormal corrosion, provided they are rinsed frequently with water and cleaned every day. "Tygon" tubing should replace the brass suction tubes (if used with this type gun) to avoid the coagulating effect of a bimetallic couple. For volume production, however, where frequent rinsing is impractical, stainless steel equipment is recommended.

Health and Safety Considerations

Many "Teflon" finishes contain material potentially irritating to the skin, and prolonged contact in the liquid or unfused states should be avoided. Spray application should be done in an adequately ventilated spray booth and a respirator should be used to avoid inhaling the atomized material. Stains from "Teflon" finishes on clothing are almost impossible to remove unless flushed immediately with soapy water. As an example of another type of contamination to avoid, spray dust settling on a cigarette in an operator's pocket may later be reduced to toxic gases when the cigarette is smoked.

Minute amounts of gaseous fluorine compounds are given off "Teflon" coatings at temperatures about 400°F., and measurable quantities are given off at 600°F. or above. These fluorine compounds may be in the form of a sublimate or a finely divided solid. At approximately 750°F. "Teflon" finishes decompose slowly. Adequate ventilation must be provided for any operation where these temperatures may be attained, because of toxicity of these gases. Similar precaution of adequate ventilation must be strictly observed whenever the final product coated with "Teflon" finishes is used at these high temperatures, or wherever "Teflon" is removed by burning off at temperatures of 950°F. and higher.

Chlorotrifluoroethylene

Chlorotrifluoroethylene was first polymerized in 1937, but it was not until the Government's atomic energy program during World War II called for materials of construction having an extreme degree of chemical and thermal stability that a high molecular weight resin was obtained in good yield. This polymer molecule consists of a carbon skeleton, with fluorine and chlorine present in a 3 to 1 ratio respectively. Commercial manufacture of polymerized chlorotrifluorcethylene was undertaken in 1947. Today it is available from several manufacturers in various forms, however, only two supply resins embodying this polymer in a form suitable for compounding into organic finishes.

The monomer of chlorotrifluoroethylene can be prepared by dechlorination of 1,1,2-trichloro-1,2,2-trifluoroethane, using zinc dust in a boiling alcohol solution:

$$CCl_2F{\cdot}CClF_2 + Zn \xrightarrow{\text{alcohol}} ZnCl_2 + CClF{:}CF_2$$

This is a colorless gas with a slight etherial odor and a boiling point of —28°C. at 1 atmosphere. Polymerization may be accomplished under the influence of peroxides and in the absence of oxygen, with long reaction times and low conversions commonplace.

Dispersions based on chlorotrifluoroethylene are composed of fine particles of the plastic suspended in a volatile organic liquid. Such dispersions can be applied to metallic surfaces. Upon heat fusion they form a tough, permanent protective coating with all the properties of the original plastic: corrosion resistance, thermal stability, abrasion resistance, nonstick and non-toxic characteristics, and high dielectric strength. A comparatively recent application of a chlorotrifluoroethylene/vinylidene fluoride copolymer has been in the coating of surfaces exposed to propellent-grade red fuming nitric acid.

Minnesota Mining and Manufacturing Company Resin

The coating resin based on chlorotrifluoroethylene as supplied by Minnesota Mining and Manufacturing Company is actually a copolymer of this resin with vinylidene fluoride and is known as *KEL-F Resin 800.* In solution, this resin forms the basis for corrosion resistant paints and lacquer which find utility where baking is impractical or where the substrate cannot withstand high fusion temperatures.

Coatings based on Resin 800, when appropriately blended with various solvents, may be applied by hot spray, cold spray, dip or flow coating. The basic solvent in any case is methyl isobutyl ketone, with amyl acetate or methyl ethyl ketone being used also, depending on the type of application conditions desired.

For hot spray application the suggested formulation is the following:

Non-Volatile Composition

KEL-F Resin 800	100.0%	(wt.)

Volatile Composition

Methyl Isobutyl Ketone	51.3%	(wt.)
Amyl Acetate	46.6	
KEL-F #1 Oil	2.1	
	100.0%	

This lacquer is conveniently prepared by dissolving the KEL-F Resin 800 in methyl isobutyl ketone to form a 45.5% (wt.) stock solution. The required amounts of amyl acetate and KEL-F #1 oil are then added to reduce the resin solids to 30.0%. The KEL-F #1 oil is present as an anti-webbing agent and to aid the flow-out of the film on the coated object. The lacquer is heated to 160°F. and applied at 20-40 psig pressure. For corrosion resistance, four coats, each 2.5 mils thick, are applied allowing a minimum of 30 minutes air dry between coats. This procedure may vary to suit the particular application. The final coating must be allowed to dry at least 72 hours prior to test exposure. The resin solids of the lacquer compounded for use with hot spray equipment is 30%.

If hot spray equipment is not available or is not applicable for any other reason, the above formulation may be reduced to 20.0%(wt.) solids with a 75/25(wt.) mixture of methyl isobutyl ketone/amyl acetate. This lacquer is sprayed at 40-50 psig pressure following all other procedures of the hot spray technique. However, approximately six coats will be required to build up a 10 mil film.

Objects that are to be dip or flow coated should be constructed so that proper drainage is provided and an excessive amount of material will not be deposited, for example, in a flat recess. The speed of withdrawal of an object from the lacquer reservoir or the rate of emptying in a flow coating operation should be such that the lacquer does not sag. This rate is approximately 3-4 inches/minute. A minimum of 30 minutes air-drying should be allowed between successive coats.

KEL-F Dispersion coatings resist attack by strong acids, alkalies, gases and oxidants at extremely high temperatures. This property makes these dispersions suitable for corrosion protection of processing equipment and for prevention of stream contamination.

Coatings made from these fluorocarbon dispersions have unusual anti-stick and self-cleaning properties. Glues, inks, paints, greases, meats, waxes, candies, rubber or casting resins will not readily adhere. When used to coat surfaces of processing equipment, clean out and shut down time are reduced.

Extreme temperature resistance of KEL-F dispersion coatings permits an operational range of 710°F. (—320°F. to 390°F.). These coatings also have high dielectric strength at low to very high operational frequencies and temperatures. Because of their zero moisture absorption and non-wetting surfaces, surface flash-over is minimized.

Firestone Resin

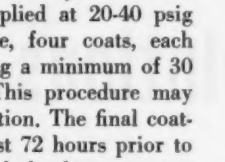
The Firestone Plastics Company manufactures a fluorine containing polymer which they call *EXON 461*, based also primarily on chlorotrifluoroethylene. It is soluble in aromatic as well as ketone and ester solvents. The resultant film is transparent, thermoplastic, highly resistant to a variety of chemicals, as well as resistant to heat, light, flame, and weather. It is nonadherent to metals and vinyl type surfaces.

Health Considerations

As mentioned in the case of the polytetrafluoroethylene resins, care should also be exercised during heat processing in the case of coatings based on chlorotrifluoroethylene so as to avoid inhalation of fumes, which may be toxic.

Vinylidene Fluoride

This chemical, mentioned previously, has the general monomeric structure:



When polymerized it forms a thermoplastic resin, crystalline in nature, and containing over 59 per cent fluorine by weight.

The polymerized resin is marketed by Pennsalt Chemicals Corp., of Philadelphia, Pennsylvania, under the name of *Resin RC-2525*. Dispersions of the resin can be applied by spray coating and casting techniques to form thin protective coatings over metals and other substrates. These dispersions are stable suspensoids of fine resin particles (1-10 microns) in high boiling solvents.

The resin is resistant to attack or penetration by most corrosive chemicals and organic solvents including mineral acids, oxidants, alkalies, halogens and hydrocarbons. Strongly polar solvents such as dimethylacetamide tend to dissolve the polymer. Certain strongly basic primary amines such as n-butylamine react with the resin to form dark brittle products.

The resin is useful for applications requiring long service life under severe atmospheric conditions. The tensile properties of thin film before and after one year exposure to an industrial atmosphere indicate that there has been little change during this period of exposure.

The resin is also extremely sensitive to ultraviolet radiation. It has high dielectric strength in thin films, an unusually high dielectric constant, and a high dissipation factor. Its dielectric strength in combination with mechanical strength, flexibility, thermal stability, and inertness to chemicals and weather suggest such applications as thin-wall primary insulation and jacketing for specialty hook-up and control wire and motor windings. Its high dissipation factor and the attendant power losses may limit its application as an insulating material for high frequency circuits.

The low temperature properties of the resin were demonstrated in a test which showed no evidence of crazing or rupture when $\frac{1}{16}$" thick sheets of the resin were cooled to —80°F. and bent around $\frac{1}{8}$" radii.

Perspective

In general, chlorotrifluoroethylene polymers are superior to polytetrafluoroethylene polymers in resistance to penetration of reagents; however, the latter are better as regards resistance to high temperatures and chemical attack. Both are probably superior to the vinylidene fluoride polymer. Coatings based on polytetrafluoroethylene are not recommended for use with corrosive liquids above 100°F. or with fluids at high pressure. Highly halogenated organic solvents, and, to a lesser extent, aromatic solvents tend to swell

(*Continued on page* 70)

Barrel Plating Solutions

By F. J. La Manna, *Technical Director, Allied Allegri Machine Co. Inc., Nutley, N. J.*

This concludes the article on barrel plating. The first half appeared in the September issue.—*Ed.*

BASICALLY, the solutions used for barrel plating are about the same as those used in still plating, except that the concentrations of the plating salts may be operated at higher values. This is advisable to prevent rapid depletion of the bath, and also to provide a better conductivity through the barrel.

Following are typical barrel plating formulations, but which can be varied to suit a particular job or situation.

Brass

Copper metal	3.5-4.0 oz./gal.
Zinc metal	1.3-1.5 "
Sodium cyanide	8.0-10.0 "
pH	10.0-11.0 "
Temperature	90-100°F.
Voltage	6-8
Current density	15-25 amp./ft.^{2}
Anodes	80% Cu, 20% Zn
Ammonia	5 cc/gal.

To maintain a uniform color on a day-to-day basis, the solution should be in proper balance at all times, but small additions of ammonia will help to stabilize the color. Paler deposits indicate an increase in zinc deposition, and can be corrected by lowering the free cyanide or current density, or by raising the temperature. Bright deposits can be obtained by proprietary brighteners, but a suitable brightener can be prepared by dissolving 35 oz. of white arsenic in a solution containing 4 lbs./gal. of caustic soda. Proper additions should be determined by Hull Cell tests, but care should be taken not to add an excess, due to the polarizing effect on the anodes.

Bronze

Copper cyanide	4.0-4.5 oz./gal.
Copper metal	2.8-3.0 "
Potassium stannate	5.0-5.5 "
Tin metal	1.9-2.1 "
Potassium cyanide	8.5-9.5 "
Free cyanide	2.8-3.3 "
Potassium hydroxide	1.3-1.8 "
Rochelle salt	5.8-6.3 "
Temperature	140-160°F.
Anodes	Copper

An alloy containing 88% Cu and 12% Sn will be obtained from the above bath, using 12 volts, and up to 40 amp./ft.^{2} in normal barrel plating. If a more golden color is desired, the free cyanide and the temperature should be increased, while the caustic content should be decreased. Tin additions should be controlled by analysis, but can be maintained adequately by adding 1.3 lbs. of potassium stannate per 1000 ampere hours. Other solutions, containing cadmium and zinc in place of tin, can be used but the Cu-Sn bath is more effective for barrel plating.

Cadmium

Cadmium oxide	2.3-3.0 oz./gal.
Total sodium cyanide	16-18 "
Caustic soda	2.0-3.0 "
Temperature	75-90°F.
Voltage	9-12 v.
Current density	5-10 amp./ft.^{2}
Anodes	Cadmium bars or balls

To maintain a high cathode efficiency and to retard carbonate formation a ratio of sodium cyanide to metal content should be maintained at 6 to 1. The relatively high caustic content will aid solution conductivity, and will also help to prevent hydrolysis of the brightener. A current density of 10 amp. ft.^{2} for 1 hour will deposit a thickness of 0.0003" of cadmium in a barrel.

Chromium

a. Chromic acid ..... 53 oz./gal.
Sulfuric acid ..... 0.53 "
Temperature ..... 70-105°F.
Anodes ..... 93% Pb-7% Sb
Voltage 12-15

b. Chromic acid ..... 53 oz./gal.
Strontium sulfate ..... 1.1 "
Potassium fluosilicate 3.2 "
Temperature ..... 90-100°F.
Anodes ..... 93% Pb-7% Sb
Voltage 12-15

Essentially, chromium plating in a barrel is similar to still tank plating, with bath (b) preferred because of its lower internal stress and higher corrosion resistance. It must be remembered that articles that are difficult to barrel nickel plate will be even more difficult to barrel chromium plate. Therefore, only very thin layers of work can be put in a barrel as contrasted with the large loads used in nickel, copper, cadmium, or zinc barrels. Thus, barrel chromium is recommended only for those parts which are not adapted to racking or wiring, and which will tumble freely. Parts which nest or interlock are not easily plated, if at all, because of insufficient contact. It is virtually impossible to plate mixtures of work in the same barrel because of the notoriously bad throwing power, which would cause the large parts to be burnt by shielding the smaller parts and drawing all the current, assuring no deposit at all on the small items.

Parts that can be barrel plated should receive a minimum of 0.0002" of bright nickel plate, and then immediately chromium plated while the articles are still wet. If the parts have to be dried and stored after nickel plating, they should definitely not be overheated during drying, since excessive oxidation will cause much difficulty in chromium plating.

At the operating conditions described above, a plating time of ten minutes will deposit an average of 0.000005" to 0.000010" of bright chromium. Thicker deposits can be obtained by longer plating times, but brightness is decreased after depositing more than 0.0001" of chromium.

Copper

Copper cyanide ..... 5.8-6.5 oz./gal.
Sodium cyanide ..... 9.0-14.0 "
Rochelle salt ..... 6.0-10.0 "
Potassium hydroxide ..... 2.0-2.5 "
Free cyanide ..... 2.5-4.5 "
Temperature ..... 120-140°F.
Voltage 9-12
Current density ..... 5-10 amp./ft.^{2}

Small additions of sodium thiosulfate or sodium sulfite will aid grain refinement or, if desired, proprietary brighteners may be added as recommended by vendor. When plating zinc die castings or similar parts, a low metal, high cyanide strike should first be used to insure good adhesion of the electroplate.

An acid type copper bath, operating at lower temperatures, is a fluoborate composition:

Copper fluoborate ..... 45-60 oz./gal.
Copper (as metal) ..... 12-16 "
pH 0.5-0.7
Temperature ..... 80-100°F.
Baume @ 80°F. ..... 29-39°
Voltage 4-12
Current density ..... 20-40 amp./ft.^{2}
Anodes ..... Copper

Air or mechanical agitation is recommended for barrel plating in the fluoborate solution, especially at the higher current densities. The bath is usually maintained by pH and Baumé measurements, with the short pH range being especially important in maintaining consistent deposits of good quality.

Gold

CONVENTIONAL GOLD:

Gold metal ..... 0.25-1.0 tr. oz./gal.
Potassium cyanide ..... 4.0-6.0 oz./gal.
Potassium carbonate ..... 2.0-4.0 "
Dipotassium phosphate 2.0-4.0 "
Temperature ..... 140-160°F.
Current density ..... 0.5-5 amp./ft.^{2}
Anodes ..... Stainless steel

The use of dipostassium phosphate is recommended in this bath to minimize the build-up of carbonate, which affects efficiency and color if the concentration rises above 8 oz./gal., to insure consistent results. It goes without saying that dragout rinses should be used after gold plating, to avoid excessive loss of solution. To prevent cyanide spotting, a hot water soak for several minutes after the dragout rinse, and a dip in 5% acetic acid are recommended.

BRIGHT GOLD SOLUTION:

Several excellent bright gold formulations are available in all types. Proprietary solutions of acid, al-

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kaline, and cyanide gold baths are currently being marketed by several companies, and all are suited for barrel plating. In general, deposits from these baths are harder than conventional gold deposits, and can be obtained as an alloy or as 24 Karat deposits. Most of these baths operate at temperature ranges from 70° to 120°F.

Iron

Ferrous ammonium sulfate	32 oz./gal.
Ammonium fluoborate	2 "
pH	5.0-5.5
Temperature	140°F.
Current density	35 amps for 6 x 12 barrel load

The plating of small parts, such as copper soldering tips, is used primarily to increase their life. Due to the high oxidation rate at the surface of the solution while plating, the barrel must be completely submerged, with continuous filtration almost a necessity. An aid to reducing evaporation and the formation of corrosion products on equipment, is the use of polyethylene floats on the surface of the solution. The above operating conditions will deposit about 0.001" per hour, and very thick deposits can be obtained by longer plating times.

Lead

Lead (as $PbCO_3$)	32 oz./gal.
Fluoboric acid	11 "
Boric acid	3 "
Bone glue	0.05 "
pH	1.0-1.5
Temperature	70-80°F
Current density	5-20 amp./ft.^{2}

The pH of the lead fluoborate bath should not be allowed to rise above 1.5, as a heavy precipitate will be formed and the bath must be discarded. The bath is also available as a proprietary concentrate, to be diluted to the proper operating conditions with water.

Nickel

a.	Nickel sulfate	24 oz./gal.
	Nickel chloride	6-7 "
	Boric acid	4 "
	Magnesium sulfate	24-32 "
	Temperature	70-80°F.
	Voltage	6-8
	pH	5.2-5.6
b.	Nickel sulfate	32-40 oz./gal.
	Nickel chloride	8-10 "
	Boric acid	5-5.5 "
	Magnesium sulfate	24-32 "
	Temperature	120-130°F.
	Voltage	12
	pH	4.0-6.0
c.	Nickel sulfate	40-45 oz./gal.
	Nickel chloride	10-12 "
	Boric acid	5-6 "
	pH	3.8-4.2
	Temperature	102-120°F.
	Current density	5-10 amp./ft.^{2}
d.	Nickel sulfate	18-22 oz./gal.
	Ammonium chloride	3.8-4.2 "
	Boric acid	3.8-4.2 "
	pH	5.0-5.5
	Temperature	70-80°F.
	Voltage	9-12
e.	Nickel sulfate	20-25 oz./gal.
	Nickel chloride	20-25 "
	Boric acid	5.0-5.5 "
	Temperature	120-130°F.
	pH	4.5-5.0

All of the above baths are well adapted to barrel plating, and all, with the exception of bath (d), are modifications of the common Watts bath. They can be used with organic brighteners if desired, but the selection of any specific bath should be dictated by the type of work to be done.

Bath (d) is a so-called hard nickel type solution which will deposit coatings with a Vickers hardness of 425, and about 6% elongation in 2 inches. Above 450°F., the deposit is softened considerably but, if used below that temperature, it can provide the surface hardness of a "soft" chromium deposit.

The sulfate-chloride bath (e) will produce a smoother, finer-grained deposit at lower voltages and higher current densities than the conventional Watts bath, which is comparatively ductile, and does not burn at the higher current densities. In addition, the bath is much more tolerant to metallic contamination and can be used over a wide operating range of its constituents.

Other baths which can be considered for nickel plating in barrels are:

f.	Nickel fluoborate	38-42 oz./gal.
	Boric acid	4.0-4.5 "
	pH	2.0-3.5
	Temperature	100-170°F.
	Current density	5-30 amp./ft.^{2}
g.	Nickel sulfamate	55-65 oz./gal.
	Boric acid	4.0-5.0 "
	pH	3.0-4.5
	Temperature	100-140°F.
	Current density	10-60 amp./ft.^{2}

The fluoborate bath (f) is capable of producing relatively heavy deposits with good ductility and low stress. The bath is exceptionally well buffered and high pH treatments may be difficult, but low-current electrolysis for long periods will eliminate metallic impurities.

The sulfamate bath (g) produces a very low-stressed nickel deposit, with high tensile strength and good ductility. If more conductivity is desired for a barrel load, about 4 oz./gal. nickel chloride will increase the conductivity as well as aid in the anode corrosion, but the deposit will be more highly stressed unless a stress-reducing agent is added. The usual stress-reducers used in this bath are saccharin or 1,3,6 trisodium naphthalene sulfonate.

As is the case with any nickel deposit, it is not advisable to overheat the coatings during drying since they will oxidize readily. Hot water that is rusty or

dirty will stain the electroplate and should be avoided.

Rhodium

DECORATIVE:

Rhodium, as sulfate	1.0 g./l.
Sulfuric acid (C.P.)	50 ml./l.
Anodes	Platinum
Temperature	110-120°F.
Current density	15 amp./ft.^{2}

At the above current density, it will require 3 minutes to deposit a thickness of 0.000005".

INDUSTRIAL:

Rhodium, as sulfate	2-5 g./l.
Sulfuric acid (C.P.)	20-50 ml./l.
Anodes	Platinum
Temperature	110-120°F.
Current density	5-20 amp./ft.^{2}

The usual precautions taken for rhodium still plating also apply to barrel rhodium plating, if not more so. Nickel coatings should be sufficiently thick (0.0003" min.) and non-porous, to prevent attack of the basis metal. Also, extreme care must be taken to promote adhesion, since rhodium deposits are not easily stripped from a rejected part without damaging the part itself.

Silver

The same general formulations are used for barrel plating as for still plating. Also the same considerations must be given to the pre-plating cycle, that is, alkaline cleaning, acid dipping, and "striking" the work in a low-metal, high-free-cyanide silver solution. The strike solutions will depend on the basis metal to be plated. However, if ferrous parts are first given a copper flash from a cyanide copper solution, the non-ferrous strike can be used exclusively for all types of metals.

STRIKE SOLUTIONS:

For Ferrous Metals

Silver cyanide	0.25 troy oz./gal.
Copper cyanide	1.5 oz./gal.
Potassium cyanide	10.0 "
Temperature	70-80°F.
Voltage	6
Current density	15-25 amp./ft.^{2}
Anodes	Stainless steel

For Non-Ferrous Metals

Silver cyanide	0.5-0.6 tr. oz./gal.
Potassium cyanide	10-12 oz./gal.
Temperature	70-80°F.
Voltage	4-6
Current density	15-25 amp./ft.^{2}
Anodes	Stainless steel

If the first strike is used on ferrous metals, then the second strike for non-ferrous metals must also be used to insure good adhesion. Therefore, if a copper strike is permissible on the steel parts, it would obviate a double strike, requiring only the non-ferrous strike for proper adhesion. After striking, the parts can be transferred directly to the silver plating bath.

PLATING SOLUTION:

The bath recommended for barrel plating is the conventional low metal bath, for economic reasons, and also because barrel silver requirements usually range between 0.0001" to 0.001" in thickness. A typical bath is:

Silver cyanide	3.0-5.0 tr. oz./gal.
Potassium cyanide	8.0-10.0 oz./gal.
Potassium carbonate	2.0-3.0 "
Potassium hydroxide	1.0-2.0 "
Temperature	70-80°F.
Current density	3-10 amp./ft.^{2}
Voltage	4-6
Anodes	Silver (high purity)
Free cyanide	5-7 oz./gal.
Silver metal	3.0-3.5 tr. oz./gal.

There should be a large enough anode area to prevent polarization of the anodes, which could result in excessive carbonate build-up, cyanide decomposition, and loss of metal in the solution. Bright silver solutions suitable for barrel plating are available as proprietary baths from many suppliers. However, the above formulation can be converted to a bright silver bath by minute additions of carbon disulfide or ammonium thiosulfate.

Tin

ACID BATHS:

1.

Stannous sulfate	12-15 oz./gal.
Sulfuric acid	15-20 "
Cresol sulfonic acid	13-15 "
Beta-naphthol	0.13-0.15 "
Gelatin or glue	0.3-0.4 "
Temperature	70-100°F.
Anodes	Tin
Voltage	6-8
Current density	5-15 amp./ft.^{2}

The above acid tin bath will produce white deposits which can be brightened by flowing in hot oil at 480°F. Compared to the alkaline tin baths, the throwing power of the acid bath is relatively poor but, because of its lower valence (Sn^{++} as compared to Sn^{++++} for alkaline baths), its deposition rate is more than double that of the stannate baths. However, because of its high acidity, the bath is much more corrosive to surrounding equipment, and barrels must be made of inert materials. Best deposits are obtained at lower current densities, especially if thicker deposits are desired. If glue is used as the grain-refining agent, a caustic soda wash (2-4 oz./gal.) should be used before plating to insure maximum adhesion of the subsequent plate.

2.

Stannous fluoborate	40-45 oz./gal.
Free fluoboric acid	7-8 "
Free boric acid	3.5-4.0 "
Gelatin or bone glue	0.8-1.0 "
Beta naphthol	0.13-0.15 "
Temperature	70-100°F.
pH	below 0.2
Current density	10-20 amp./ft.^{2}
Voltage	4-6
Anodes	Tin

Better solderability plus higher permissible current densities is claimed for the above bath, which can easily be maintained by pH and specific gravity (21-23° Bé) measurements, or by chemical analysis if desired. Air agitation is definitely *not* recommended for this solution.

ALKALINE BATHS:

1. Potassium stannate ..... 20-25 oz./gal.
   Free pot. hydroxide ..... 3-3.5 "
   Temperature ..... 150-190°F.
   Voltage 9-12
   Current density ..... 3-10 amp./ft.^{2}
   Anodes ..... Tin
2. Sodium stannate ..... 20-25 oz./gal.
   Free sod. hydroxide ..... 2.5-3.0 "
   Temperature ..... 140-160°F.
   Voltage 9-12
   Current density ..... 2-10 amp./ft.^{2}
   Anodes ..... Tin

Although the potassium bath has more conductivity and a slightly higher plating speed, it requires higher operating temperatures. As in still baths, anode control is very important to the quality of the deposit. Anode current densities in both baths should be controlled so that there is a light yellow-green film on the anodes at all times. If the film doesn't form, or is lost, the tin will dissolve as stannite, and faulty deposits will usually be obtained, especially if the parts are to be re-flowed. Black or brown films on the anode indicate passivity of the anode, which will result in rapid depletion of the metal in the solution, since the anodes are not dissolving. Agitation is not normally recommended because of the insoluble white sludge, which settles to the bottom of the tank. The solutions can be kept clean by periodically decanting the clear solution and discarding the sludge. If practical, the sludge can be accumulated and sold to a smelter for refining.

Zinc

Zinc cyanide	8 oz./gal.
Caustic soda	10-12 oz./gal.
Sodium cyanide	5.3-6.0 "
Total sodium cyanide	12-13 "
Temperature	80-85°F.
Voltage	10-15
Current density	2-10 amp./ft.^{2}
Anodes	Zinc and steel

Proprietary brighteners are available to produce a bright finish on barrel-plated zinc parts, but a suitable brightener can be made by adding sodium sulfide flakes at the rate of 0.03 oz./gal. per 24 hours of steady production.

Steel parts should be given a pre-plating dip in a solution of 4-6 oz./gal. sodium cyanide, and 2-4 oz./gal. of caustic soda to prepare the steel surfaces for rapid deposition of the zinc.

To improve luster and corrosion resistance, the zinc-plated parts should be bright dipped following the plating cycle. A ½% nitric acid solution, or a chromate type bright dip followed by a caustic soda bleach, will produce a pleasing finish. The chromate solution is recommended only if the barrel load is first removed from the barrel, to avoid contamination in subsequent plating operations.

Anode corrosion and excessive metal build-up in the solution can be controlled by connecting the anode bars directly to the tank, thereby using the tank as an auxiliary anode, in addition to the regular zinc anodes.

Acid zinc bath formulations also can be used for barrel plating in certain applications, but these are limited and of little practical value, so will not be discussed here.

SYNTHETIC RESINS

(*Concluded from page* 65)

fully "quenched" chlorotrifluoroethylene polymers at elevated temperatures, the swelling being a plasticizing action resulting in a more flexible material. This resin remains flexible and tough even at temperatures as low as —320°F. (temperature of liquid nitrogen).

The unusual combination of useful characteristics of the fluorocarbon resins have not been equalled anywhere in the chemical industry. As a result, the industry as a whole has flourished. The companies mentioned in this article represent only a few of the producers of fluorocarbon chemicals; other firms as well as those mentioned herein make chemicals based on fluorine for use as refrigerants, as propellants in food aerosols, as clear films, as elastomers, as fire extinguishers, etc. Yet, plant capacity exceeds the estimated 1960 production by a good margin. This, in itself, should tend to gradually reduce the price of this resin.

In the field of coating resins, the fluorocarbons occupy an exceedingly small niche, price being the chief drawback. In our next article we will discuss a family of resins that has come of age at the same time as the fluorocarbons, but wherein price offers no great problem, namely the epoxies.

References

1. Fluorocarbons. Chemical and Engineering News. July 18, 1960. Page 92.
2. Polymers and Resins by Brage Golding. D. Van Nostrand Co., Inc. 1959.
3. Source Book of the New Plastics by H. R. Simonds. Reinhold Publishing Corporation. 1959.
4. Fluorocarbons by M. A. Rudner. Reinhold Publishing Corporation. 1958.
5. A Concise Guide to Plastics by H. R. Simonds. Reinhold Publishing Corporation. 1957.
6. Literature supplied through the courtesy of E. I. DuPont de Nemours & Co. (Inc.), Minnesota Mining and Manufacturing Company, Firestone Plastics Company, and Pennsalt Chemicals Corporation.

FINISHING POINTERS

How Current Efficiencies Affect Solution Control

By Edward F. Duffek
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PLATERS are frequently perplexed when their electroplating solutions increase in caustic, acid, or metal content without outside introduction by some means. Other than solution "drag-in", one reason for this occurrence is due to a difference in anode and cathode current efficiencies. The ideal condition for maintaining solution composition is where the anode and cathode efficiencies are 100%. If the cathode current efficiency is less than the anode efficiency the solution will become more alkaline and will show an increase in metal content. For example, a high efficiency copper cyanide solution operating two shifts a day with 100% anode and 90% cathode efficiency will gain 0.5 to 1 oz./gal. caustic potash per week. The excess caustic potash is objectionable because the deposits are hard and difficult to buff. The alkalinity increase is explained as follows.

Cathode reactions:

$$Cu(CN)_2^- + e \rightleftarrows Cu + 2CN^- \quad (1)$$
$$2H_2O + 2e \rightleftarrows H_2 + 2OH^- \quad (2)$$

Anode reactions:

$$Cu + 2CN^- \rightleftarrows Cu(CN)_2^- + e \quad (3)$$
$$2OH^- \rightleftarrows H_2O + \tfrac{1}{2} O_2 + 2e \quad (4)$$

If the anode current efficiency is greater than the cathode efficiency, the rate of reaction (2) will be greater than (4). The solution will therefore become more alkaline, especially where "drag-out" is low.

A similar occurrence happens in the case of acid copper plating. With the normal operation the copper sulfate content increases and the sulfuric acid content decreases — due to anode efficiencies greater than 100%. However, under certain conditions it may be found that the acid content actually increases. This is explained as follows.

Cathode reactions:

$$Cu^{++} + 2e \rightleftarrows Cu \quad (1)$$
$$2H^+ + 2e \rightleftarrows H_2 \quad (2)$$

Anode reactions:

$$Cu \rightleftarrows Cu^{++} + 2e \quad (3)$$
$$H_2O \rightleftarrows 2H^+ + \tfrac{1}{2} O_2 + 2e \quad (4)$$

When the rate of (4) is greater than (2) the pH of the solution will decrease because of the increased formation of hydrogen ions. If reaction (4) becomes extensive, only hydrogen ions and oxygen are formed and the anodes are said to be polarized. The copper content of the solution will also decrease. Reasons which would cause this are a low ratio of anode to cathode area, tank overloading, poor contact to bus bars, or improper control.

When the observations described above are found, methods of increasing the cathode or anode efficiency must be sought. For example, cathode efficiencies are increased by increasing metal content, temperature, and agitation, and lowering cyanide or acid content.

The anode and cathode reactions given above are general and may be applied to all electroplating systems. Table I contains cathode and anode efficiencies for some of the common electroplated metals based on current densities for commercial applications. Plating systems with inert anodes are shown as 0% efficiency. Solution composition changes which may be expected on the basis of these current efficiencies are also given.

Current Efficiencies for Electroplating Solutions

Metal	Type	Current Efficiency (%) Cathode	Anode	Solution Changes
Au	cyanide	up to 100	0	pH and metal decrease
Ag	cyanide	100	100	none
	"strike"	20-50	0	pH, metal decrease
Brass	cyanide	75	95	pH, metal decrease
Cd	cyanide	85-98	100	pH, metal increase
Cr	acid-sulfate	15	0	pH, metal decrease
Cu	Rochelle	30-70	30-70	Variable
	sulfate, fluoborate	99-99.5	101-102	pH, metal increase
	high efficiency	95-100	100	pH, metal increase
Fe	sulfate	80-90	101-102	pH, metal increase
In	cyanide	50-75	0	pH, metal decrease
	fluoborate	40-75	100	pH, metal increase
Ni	hard nickel	95-100	70-90	pH, metal decrease
Pb	fluoborate	90	100	pH, metal increase
Pt	DNS	10-15	0	pH increase, metal decrease*
Sn	stannate	60-90	60-90	variable
Zn	cyanide	75-95	100	pH, metal increase

*Due to unusual electrode reactions wherein nitrate is formed at the anode and ammonia at the cathode.

Science for Electroplaters

60. Causes of Poor Adhesion

By L. Serota

This concludes Part LX of the series by Mr. Serota. The first half appeared in the September issue.—*Ed.*

CHROMIUM — STAINLESS STEEL:

A method of obtaining adherent electrodeposits of nickel on chromium and stainless steel was investigated by G. E. Gardam. The difficulty in obtaining effective adhesion of the deposit is generally associated with the presence of an oxide film on the metal. A satisfactory method developed by Gardam requires cathodic treatment in a strongly acid solution of nickel sulfate. This method serves to remove the oxide film and, at the same time, deposit a nickel film.

Following degreasing or alkaline cleaning of the chromium plated or stainless steel object, the sample is made the cathode in a solution containing nickel sulfate (240 g./l.) and sulfuric acid (50 g./l.). The bath is operated at a temperature of 30°-40°C. for 5-10 minutes at a current density of about 1.50 amp./ft.^{2}, followed by a standard nickel plating operation. The suggestion is made that very good adhesion is insured if the cathodically treated sample is transferred rapidly, without rinsing, to an acid copper plating solution before the final nickel deposit. For best adhesion, a layer of copper 0.001"-0.002" thick is required. It was also found that a 15 minute deposition cycle in the acid nickel solution will cause poor adhesion even when deposition of the layer follows this step. Results for adhesion of electrodeposits to chrome alloys, under varying conditions, are summarized in Table IV.

Deposition of metallic films during the electrolytic alkaline cleaning cycle, or formation of insoluble silicates or aluminates from compounded cleaners, it is indicated, must be avoided during this process. Some procedures suggested to reduce these difficulties include dipping the article in a 10-15 per cent nitric acid solution; or scouring with pumice powder or chalk following degreasing.

The nickel deposit on the defilmed surface is considered important in preventing film re-formation during subsequent operation, as well as avoiding dissolution of the activated chromium. Reduction of the oxide film is effected by rapid evolution of hydrogen, and nickel deposition at the proper rate by the use of a high current density (150 amp./ft.^{2}).

NICKEL STRIKE:

D. Wood reports that the use of a nickel strike for plating steel on stainless steel improves adhesion. This method, the author contends, will give better adhesion than that obtained by the Gardam method, unless the Gardam method is preceded by a hydrochloric acid etch. Good throwing power is obtained and adhesion for the deposited nickel is found to be virtually independent of current density. The process involves cathodic treatment in a solution containing nickel chloride, 32 oz./gal., and hydrochloric acid (22° Bé), 16 fl. oz./gal. at room temperature and a current density of 50-75 amp./ft.^{2}.

The nickel strike, in addition to its efficiency as treatment for stainless steel, has been found especially useful as a preliminary step when two metals are present on the same specimen. Satisfactory adhesion on such specimens ordinarily is not obtained when the cyanide or acid dip is used for removal of the oxide film, a condition attributed to the formation by the metals of an electrolytic cell. With one of the metals acting as an anode, an oxide coating will form. This condition, it is indicated, may arise in the cyanide or acid dip which is used, specifically, to dissolve the oxide. Cathodic treatment at a potential large in relation to the potential differences involved in the cell effect will minimize the tendency towards anodic oxidation of one of the metals. This method (nickel strike), Wood notes, has been found to be quite useful to reduce oxides and, in the same operation, give a coating of nickel on dissimilar metals.

CADMIUM:

Plating of the 400 series stainless

TABLE IV

Adhesion of Electrodeposits to Chromium Alloys

Degreased specimens were cathodically treated for 5 minutes at 150 amp./ft.^{2} in a solution, nickel sulphate 240 g./l., sulphuric acid 50 g./l.

Basis Metal	*Nickel deposition*	*Adhesion after:— Nickel deposition and heat treatment at 200°C., 2 hrs.*	*Copper deposition 0.001—0.002 inch followed by nickel deposition*
Stainless steel C. 0.43% - Ni. 0.15% Cr. 13.4%	Poor*	Fair*	Good†
Stainless iron C. 0.10° - Ni. 0.20% Cr. 14.7%	Poor*	Fair*	Good†
Stainless steel and brass in contact (approximately equal areas)	Poor* (Brass & steel)	—	Copper 0.0005 inch thick Fair (on steel)* Good (on brass)†
Nichrome rod	Poor*	Fair*	Good†

*Fracture at or near basis metal surface.
†Fracture in copper layer.

steels with cadmium (cyanide bath), which in some instances is desirable, presents a problem similar to that experienced in plating aluminum, namely, that of obtaining an adherent deposit due to the passivity of the thin surface oxide film. The common pickling method for removing this film before cadmium plating from the cyanide bath was not found satisfactory by L. Domnikov, because of the rapidity with which the film reformed between the steps required for preparation of the specimen, and the inability of the cadmium cyanide solution to remove the oxide.

An adherent deposit of cadmium was obtained by the author by depositing an undercoat of copper or nickel first from baths containing a high acid concentration. For this purpose the initial copper or nickel strike was applied from the respective baths having the following composition: (a) copper sulfate, 0.66 oz./gal.; hydrochloric acid (18° Bé), 50 per cent solution. (b) nickel chloride, 32 oz./gal.; hydrochloric acid (18° Bé), 11 oz./gal.; or, nickel sulfate, 30 oz./gal.; sulfuric acid (specific gravity 1.84), 6.6 oz./gal.

When a copper undercoat was applied to the 400 stainless steel, the steel panel was prepared by using an alkaline cleaner, at a temperature of 190°-210°F. and a current density of 50-100 amp./ft.^{2}. A 45 second anodic treatment cycle was followed by cathodic treatment for 30 seconds, then anodic treatment again for 45 seconds. A rinse in cold water was followed by an acid dip for 5 seconds in a fluoboric acid solution at room temperature, and a final rinse in cold water. The specimen was then placed in the acid copper tank and treated anodically for 30 seconds, then cathodically for 60 seconds, at room temperature, at a current density of 5-25 amp./ft.^{2}.

For the nickel strike, following the cleaning cycle described, an anodic treatment for 30 seconds was followed by a cathodic operation for 120 seconds, at room temperature, at a current density of 50-75 amp./ft.^{2}. When the nickel sulfate bath was used for the undercoat, the steel panel was treated cathodically, following cleaning for a 5 to 10 minute period at 150-200 amp./ft.^{2}, at a temperature range of 95°-105°F.

An additional method proposed for the nickel undercoat is the electroless application. Following the cleaning process, the sample is given a two minute immersion in a 35 per cent sulfuric acid solution at 165°F., then a nickel strike in a bath containing 8 oz./gal. nickel chloride and 5.5 oz./gal. boric acid, at pH 4.3-4.7. Immersion time in the nickel bath is 1 minute, at a temperature of 160°F. The specimen is then rinsed, given a cyanide dip (NaCN, 6 oz./gal.), and cadmium plated from a cyanide bath. The electroless process for the undercoat, Domnikov found, gave the best corrosion-resistant deposits. The bond test for adhesion of cadmium gave satisfactory results for the four methods used for obtaining undercoats.

Aging

P. A. Jacquet observed that continued use of an acid copper sulfate bath will have a pronounced effect upon the adhesion of copper deposits on nickel. For example, copper deposits on nickel from a solution (labeled bath A) containing 250 g./l. $CuSO_4 \cdot 5H_2O$, and 96 g./l. H_2SO_4, after the tank had been worked for 14 hours, gave the following adhesion values: copper and rough nickel surface — 5,700 g (grams necessary to detach the strip); copper on a polished nickel surface — 5,300 g.

When copper was deposited on nickel from a solution labeled bath B, of similar original composition as bath A, following an electrolysis period of 140 hours, the following average adhesion values were obtained: copper on a rough nickel surface — 10,200 g.; copper on a polished nickel surface — 14,700 g. Analysis of the bath after this last adhesion test gave the following composition: $CuSO_4 \cdot 5H_2O$ — 257 g./l., and only 51 g./l. H_2SO_4, a decided decrease in acid.

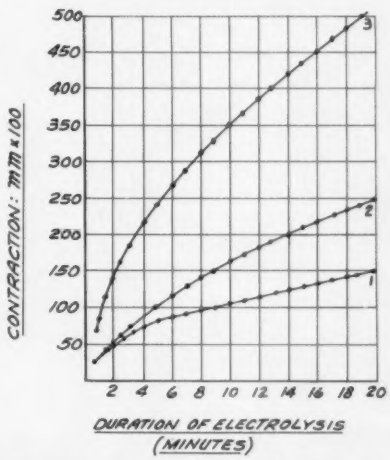


Fig. 239. Increase in mechanical strain developed in the cathode during plating of copper on nickel. The poorer the adhesion of copper, the greater the strain. (Contraction.) Curve 1: Adhesion of copper on rough nickel, 10,900 g.; on polished nickel, more than 14,700 g. Corresponding figures for Curve 2 are 5,700 g. and 5,300 g.; and for Curve 3: 550 g. and 2,400 g.

Although the greater adhesion of the copper deposit after the 140 hour period of electrolysis could be attributed to the lower sulfuric acid concentration, Jacquet showed that this difference in acid concentration was not the cause by preparing a solution, labeled bath C, containing 250 g./l. $CuSO_4 \cdot 5H_2O$ and only 48 g./l. H_2SO_4, and studying the adhesion values after the bath was used for 14 hours. Unlike the high adhesive values obtained from bath B, with low acid concentration, the adhesion values in this case, bath C, were only 550 g. for copper deposited on rough nickel and 2,400 g. for copper deposited on polished nickel.

To account for such variations in adhesion values, the relationship of adhesion to mechanical strain developed in the deposited copper was investigated. The mechanical strain is measured by observing the displacement through a microscope of the lower edge of an annealed cathode lamella. The strain effect will result from contraction with the cathode bending toward the anode, or expansion with the anode bending in the opposite direction. For the microscope reading, 1 mm on the scale corresponds to 0.01 mm displacement of cathode lamella edge.

The parallel between mechanical strain and adhesion of copper deposit, shown in Fig. 239, was made with deposits from solutions similar in comparison to the three baths A, B and C indicated in the adhesion tests. Contraction (mechanical strain) is plotted against duration of electrolysis in minutes. The copper deposit represented by curve 1, and corresponding to the composition, time, and adhesion values of bath B, shows a mechanical strain quite different from the greater strain developed when the deposit, shown as Curve 3, was made from a solution corresponding in composition, time, and adhesion values to bath C. Curve 2 represents the strain for the copper deposit from a solution corresponding in composition, time and adhesion to bath A. The graph, Jacquet contends, shows the relationship between adhesion and strain (contraction). Curve 3, with the poorest adhesion values, shows the greatest strain. It is also in-

(*Concluded on page 79*)

SHOP PROBLEMS



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Blue Color on Guns

Question: Is there any simple way to produce the blue finish on guns? We are using a caustic solution to produce black at present, but would like a blue finish.

G. W. G.

Answer: Although there are a number of methods for producing a blue color, most of these result in fugitive shades, which require lacquering. The blue color on guns is a temper color, produced by heating to a temperature of about 575 deg. F.

The procedures described in the METAL FINISHING GUIDEBOOK produce a gray-blue shade.

Water for Plating

Question: The water analysis of our deep well, which has been standing idle for some five years, is as follows:

Hardness as $CaCO_3$	82	ppm
Carbon Dioxide as CO_2	14	"
Silica as SiO_2	6	"
Sodium Salts as $CaCO_3$	--	"
Chlorides as Cl	10	"
Sulphates as SO_4	10	"
Total Dissolved Solids	162	"
pH	6.2	
Iron as Fe	0.23	ppm
Turbidity as SiO_2	2	"

We desire to use this water in our plating tanks and also for rinse for hard bright chromium, bright cadmium, copper, tin, and possibly some gold and silver, as well as zinc.

From the information, will you advise us if there is any objectionable property in this water that should be corrected before we attempt to use, either in the plating baths or for rinsing?

G. A. M.

Answer: The water supply would be considered slightly hard, but quite suitable for the requirements, in general. The somewhat low pH of the water will affect the piping and fixtures, of course, and we would suggest that corrosion resistant material be used in the line to the plating department to avoid dissolved iron entering the baths.

The total solids content, although satisfactory for the plating solutions and rinses, may result in troublesome water spots in the final rinsing and drying operations. If so, the water feed to the final rinse may be deionized.

Low Stress Barrel Nickel

Question: I noticed in the Shop Problem section of METAL FINISHING that saccharin can be added to relieve stress in Watts barrel nickel solution. How will this affect the ductility and brightness without a wetting agent?

For stress relief Toluene - P - Disulfonic acid, Toluene - P - Sulfonamide (brighteners of the first class), are also stress relieving. What quantities and voltage are necessary to use these acids? Is a wetting agent necessary when using these?

Will these acids give sufficient brightness without using a brightener of the second class such as cadmium: How can these be analyzed for quantity oz./gal. in solution?

We leave our barrel nickel tanks loaded overnight after depositing about 30 min. plating. Is there a possibility of iron contamination from this method (steel parts)?

J. E. T.

Answer: Saccharin and other stress reducers can be used at the rate of 1 lb. per 100 gallons of solution. No changes are required in operating conditions and, for practical purposes, there is no effect on ductility. Brighteners will still be required despite the addition of stress reducer.

The analysis of such small amounts of organic matter requires very highly specialized techniques, so that determination of the stress effect, by means of a Spiral Contractometer on Stesometer, is generally resorted to.

A small amount of iron will dissolve from the parts left in the plating solution overnight, even though they have been nickel plated, because deposit coverage is not complete, and the amount will be greater in low pH solutions. However, the iron deposits out quite rapidly and, if plating is satisfactory the following morning, it would indicate that contamination is negligible.

Rochelle Salt Analysis

Question: Kindly send me a more detailed explanation of your rochelle salt analysis located in the METAL FINISHING GUIDEBOOK. My main difficulty is identifying the precipitation change from the 10% silver nitrate solution in step 4. Please give me the chemical equations so that I can determine what the cause of difficulty is.

J. N.

Answer: The addition of silver nitrate is for the purpose of removing copper and cyanide from the solution. The reactions are as follows:

1. $NaCN + AgNO_3 = AgCN\downarrow + NaNO_3$
2. $Na_2Cu(CN)_3 + 2AgNO_3 = CuCN\downarrow + 2AgCN\downarrow + 2NaNO_3$

In the first equation, the *free* cyanide is precipitated as insoluble silver cyanide, and in the second equation both the copper and *combined* cyanide are precipitated as insoluble cyanides. These precipitates are white, but excess silver nitrate causes the solution to turn gray or black.

The nitrobenzene causes the precipitate to coagulate rapidly and settle out in the flash. An additional 5 ml. of water are added to make up for the 5 ml. of nitrobenzene.

Fixture Deburring

Question: We have a problem of deburing parts made in a punch press. They go to the milling machine for

another operation, then they are hardened and, after that they are carbide milled. Then we must remove the burrs. The pieces weigh about 2½ pounds and we think an ordinary tumbler would "nick" the parts or, they would be "dubbed" over at the edges and corners. We enclose a paper pattern of the parts.

Would like your suggestion as to how we can lick these problems. Your immediate reply will be appreciated.

N. P.

Answer: Nicking of heavy parts during barrel deburring can be avoided by using a fixture barrel, in which a number of parts are mounted on a jig to avoid contact with each other, then inserted in the barrel with the media and compound. Special barrels are available with large doors for easy insertion of the fixture, and you can communicate with barrel manufacturers for suggestions.

Wetting Agents in Nickel Baths

Question: Do you have any information available on the effect of wetting agents, or non-pitters on the hardness of nickel deposits?

H. N.

Answer: The effect on the hardness will depend on the type of wetting agent added to the nickel solution. Anionic types, such as the commonly employed lauryl sulfates, are stated to reduce the hardness. Recent work indicates a reduction of almost half (H. Spahn. Metalloberflache, **13,** 259, 1959). However, others, similar to the non-ionic types, will increase the hardness and, if added in sufficient amounts, will cause brittleness.

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Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Electroforming Method

U. S. Patent 2,932,609. *Apr.* 12, 1960.
N. J. Pierce, assignor to Bell Telephone Laboratories, Inc.

An electroforming method comprising wetting the surface of a non-conducting mandrel with a first suspension consisting essentially of graphite in a volatile medium, evaporating the volatile medium contained in said first suspension so as to deposit a layer of graphite on said surface, wetting said surface with a second suspension consisting essentially of graphite and an elemental metal selected from the group consisting of iron, zinc and cadmium, in a volatile medium, evaporating the volatile medium contained in said second suspension so as to deposit a layer of graphite and metal on said surface, immersing said mandrel in a copper salt solution so as to deposit a layer of metallic copper on said mandrel by the chemical replacement of said metal and utilizing said metallized copper layer as a cathode for the electrolytic deposition of a layer of metal thereon.

Metal Strip Plating

U. S. Patent 2,933,438. *Apr.* 19, 1960.
L. E. Lancy

In a method of electroplating metal strip which is being progressively advanced out of a plating solution, upon a contact roll, and then into a plating solution; the steps of conditioning the content of the solution carried over on the strip when the strip is advanced from the plating solution to the contact roll by changing the ratio of cations to anions in the carried-over solution to at least 1 to 4 in favor of the anions to substantially inhibit electroplating action of the carried-over solution on the contact roll and renew the content of the plating solution when the strip is then advanced into it and without adversely affecting the electroplating action of the plating solution on the strip.

Probe for a Thickness Testing Gage

U. S. Patent 2,933,677. *Apr.* 19, 1960.
S. U. Lieber, assignor to Unit Process Assemblies, Inc.

In a thickness testing gage for testing the thickness of an electrically non-magnetic layer over a different conductivity non-magnetic material base and employing a radio frequency energization signal and a bridge network including a tuned circuit in one arm thereof, a probe comprising a single layered coil, a low-loss ferromagnetic material core for said coil, and an electrically floating shield of the same material as said core, said shield surrounding said core for eliminating stray field effects and for concentrating the effective measuring area of said probe, the coil of said probe being an element of said tuned circuit.

Anodizing Barrel

U. S. Patent 2,933,443. *Apr.* 19, 1960.
C. H. Parsons, assignor to Fansteel Metallurgical Corp.

An electro-forming tank comprising a receptacle having a tantalum interior surface, a cathode suspended in said receptacle, a rotary assembly in said receptacle, said assembly including a tantalum shaft, shaft extensions of insulating material secured to the ends of said tantalum shaft, bearings of insulating material within said receptacle for engaging said insulating shaft extensions so that said tantalum assembly is insulatingly supported from said receptacle, an insulating shaft having a tantalum core passing from said receptacle to the outside, insulating means for supporting said insulating shaft on said receptacle so that said shaft is insulatingly supported while being susceptible to being driven by external motor means, means for mechanically connecting said insulating shaft with said tantalum shaft for driving the same, means for electrically connecting the metal core of said insulating shaft to said tantalum shaft, tantalum clips having sharp jaws connected to said tantalum shaft for gripping work pieces and cutting through any electrical insulating film on the work pieces, means for establishing an electrical connection externally of the tank to the core of said insulating shaft, said work pieces held by said clips being metallically connected to said connection-establishing means so that said work pieces function as anodes, said various tantalum surfaces within said receptacle having a film formed thereon capable of withstanding a potential at least as great as that used across the cathode and anode work piece.

Masking Printed Circuits

U. S. Patent 2,934,479. *Apr.* 26, 1960.
L. L. Deer, assignor to the United States of America

The method of making a printed circuit board comprising, reverse printing with a material resistant to electroplating a conductive pattern on a board of metal clad base material, coating with polyvinyl chloride a portion of the surface of said board, electroplating said uncoated portion with a first metal, removing said polyvinyl chloride coating and then applying another coating of polyvinyl chloride to the electroplated portion, then electroplating said uncoated portion of said board with a metal different from said first metal, next removing said polyvinyl chloride coating and said material resistant to electroplating, and then etching in a solution which does not attack said electroplating, thereby producing a conductive pattern on said board.

Photo-Sensitizing Anodized Aluminum

U. S. Patent 2,935,403. *May* 3, 1960.
M. H. Dickerson, assignor to Horizon Incorporated

A process of forming a Prussian Blue image on an aluminum base metal surface which comprises: anodizing the aluminum base metal surface to form a porous oxide surface layer thereon; immersing the anodized surface in a sensitizing solution comprising a 30% solution of ferric ammonium citrate; exposing the sensitized surface to a pattern of illumination; treating the surface, after said exposure, with a solution of potassium ferro-

cyanide, for between about 10 and 30 seconds, and with sufficient agitation to wash away spurious images; intensifying and developing a Prussian Blue image corresponding to the pattern of illumination by applying a very weak aqueous solution of hydrogen peroxide to said surface and thereafter sealing the intensified image in the porous metal surface by immersing the surface bearing the intensified image in boiling water for about 30 minutes.

Hot Dip Aluminum Coating

U. S. Patent 2,935,419. *May* 3, 1960. *D. W. Mitchell, assignor to American Mollerizing Corp.*

A method of coating a base metal with a molten aluminum and an aluminum containing alloy which comprises: dipping the metal to be coated into a molten pretreating bath comprising 97-99.99% of molten halide salts selected from the group consisting of chlorides, bromides, iodides and fluoride salts, and 0.01-3% of hydride selected from the group consisting of calcium, barium, and lithium hydride, to thereby substantially completely eliminate the oxides from the surface of said metal; and passing said oxide-free metal directly into, and through, an interconnecting aluminum-coating layer.

Hot Dip Magnesium Coating

U. S. Patent 2,935,421. *May* 3, 1960. *D. S. Chisholm, assignor to The Dow Chemical Co.*

The method of coating a steel surface with magnesium metal consisting essentially of immersing the steel having a surface to be coated in molten magnesium which is superimposed on a layer of molten saline flux selected from the class consisting of a halide of an alkali metal, an alkaline earth metal, and mixtures thereof, passing $TiCl_4$ gas upwardly through said flux and into said molten magnesium while positioning said steel surface so immersed so that it is contacted by the rising $TiCl_4$ gas.

Hot Dip Coating

U. S. Patent 2,935,420. *May* 3, 1960. *H. E. Linden*

A method of coating a base metal with a molten coating substance which includes the steps of: placing a coating substance on at least a portion of the surface of a packed bed of finely divided heat-resistant granular solids, said coating substance floating on said packed bed; heating said packed bed to a temperature at least equal to the melting point of said coating substance, said coating substance being melted by heat transferred from said packed bed to said overlying coating metal; passing said metal to be coated into and through said heated packed bed to thereby cause said base metal to be heated; and passing said heated metal from said bed of granular solids directly, without any intervening oxidation, into said molten coating substance to be thereby coated.

Coating Magnesium

U. S. Patent 2,935,423. *May* 3, 1960. *W. H. Kapfer and M. Kronstein, assignors to the United States of America*

A process for applying a protective coating to a magnesium surface said process comprising the steps of cleansing said surface; contacting the surface with an aqueous solution having an elevated temperature and consisting essentially of 50-95 parts by weight of sodium pyrophosphate, 1-5 parts by weight of sodium fluoride, and 4-40 parts by weight of a metallic salt selected from the group consisting of cadmium sulfate, copper sulfate, chromium sulfate, nickel sulfate, cadmium cyanide, chromic nitrate, and aluminum nitrate; rinsing the surface; drying the said surface in the air; immersing the said surface in a 5-40% by weight aqueous solution having an elevated temperature of one from the group consisting of iron phosphate, ammonium vanadate, and sodium dichromate; and rinsing the surface so that the coated surface exhibits a high degree of uniformity and stability.

Corrosion Preventive

U. S. Patent 2,935,432. *May* 3, 1960. *L. K. Schuster, H. A. Whitenight and W. A. Jung, Jr., assignors of one-half to Reilly-Whiteman-Walton Co., and one-half to Kelsey-Hayes Co.*

A metal coating preparation consisting essentially of a hydrophilic organic compound having from 12 to 30 carbon atoms in a connected group, up to 90% by weight of substantially nonvolatile organic metal lubricant, about 1% to 15% water by weight, and 2.5 to 25% by weight of an acid selected from the class consisting of phosphoric and phosphorous acids, said water and said acid being dissolved in the organic material, and the preparation being a stable single phase liquid at a temperature at least as low as 80°C.

Electroless Nickel

U. S. Patent 2,935,425. *May* 3, 1960. *G. Gutzeit, P. Talmey and W. G. Lee, assignors to General American Transportation Corp.*

The process of chemically plating with nickel a body comprising an element selected from the group consisting of iron, cobalt, nickel, aluminum, copper, silver, gold, palladium and platinum, which comprises contacting said body with a bath comprising an aqueous solution of a nickel salt and a hypophosphite and a first chelating agent selected from the group consisting of malic acid and salts thereof and a second chelating agent selected from the group consisting of lactic acid and salts thereof and an exalting additive selected from the group consisting of succinic acid and salts thereof, the ratio between nickel ions and hypophosphite ions in said bath being in the range 0.25 to 1.60, the absolute concentration of hypophosphite ions in said bath being in the range 0.15 to 1.20 mole/liter, the absolute concentration of malic acid ions in said bath being in the range 0.04 to 0.20 mole/liter, the absolute concentration of lactic acid ions in said bath being in the range 0.04 to 0.20 mole/liter, the total quantity of said first and second chelating agents in said bath being sufficient to chelate at least 100% of the nickel ions therein so as to impart to said bath a phosphite tolerance of at least about 1 mole/liter, and the absolute concentration of succinic acid ions in said bath being at least 0.04 mole/liter so as substantially to exalt the plating rate of said bath.

Electropolishing

U. S. Patent 2,935,455. *May* 3, 1960. *F. J. Swagler, assignor to Poor & Co.*

A process of chemically polishing a metal surface susceptible to polishing in a phosphoric acid bath which comprises applying a direct current voltage within the range of 1 to 20 volts at a current density within the range of 10 to 150 amperes per square foot to said metal surface as the anode in a bath consisting essentially of an aqueous solution of phosphoric acid, as substantially the sole acid, containing up to 50% by volume of water

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Ideal for shops with varied operations. Gives full or semi-bright plate on zinc base die castings, steel, brass or bronze.

EASY-TO-USE—A single addition agent for rack or barrel plating. Easily controlled for desired brightness level.

HIGHLY ECONOMICAL—Use as semi-bright at half the cost of full bright solutions.

VERSATILE—Easily buffed to cover wheel marks. Also brightens well in areas not easily accessible to buffing. Use in rack or barrel plating operations.

ISOBRITE® COPPER #625 BUFF BRIGHT

Produces a very soft plate for quick buffing.

A COMPLETELY ORGANIC SYSTEM—No metallic constituents.

VERY ECONOMICAL—Works well over wide variations of temperatures and concentrations.

EXCELLENT FOR STOP-OFF—Produces plate that resists penetration by heat-treating or case hardening.

VERSATILE—Use in cyanide solutions with or without tartrates, Rochelle salts or proprietary substitutes.

These Isobrite Copper Processes contain no lead and are ready to work as soon as current is turned on, even after week-end shut downs. This means increased production and substantial savings by eliminating poorly plated rejects.

Auxiliary Addition Agents for Added Efficiency and Economy

ISOBRITE #630 Aids anode corrosion for greater efficiency and produces finer grained deposits.

ISOBRITE #631 Chrome reducer. Wide range of operation. Forms no undesirable breakdown products.

ISOBRITE #627-W Wetting agent. Non-ionic surface agent with low-foaming action.

ISOBRITE #628-W High detergency type wetting agent for severe organic contamination. All our wetting agents are easily cleaned from parts to give good nickel adhesion.



See your Allied Field Engineer for complete information and recommendations for the specific process that best meets your requirements. He's listed under "Plating Supplies" in the yellow pages. Or, write for FREE TECHNICAL DATA FILES.

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Chemical and Electrochemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing

IRIDITE® Chromates | IRILAC® Coatings | ISOBRITE® Brighteners | ARP® Supplies | WAGNER Equipment

and 0.2% to 2.0% by weight of the phosphoric acid of an oxyalkylene compound having a molecular weight of at least 200, said oxyalkylene compound being soluble in the bath in the proportions used and under the conditions of polishing, said oxyalkylene compound being from the class of compounds consisting of normally liquid polyoxyalkylene glycols and aliphatic ethers of such glycols in which the oxyalkylene groups are from the class consisting of oxylethylene groups, oxy-1,2-propylene groups and both oxyethylene groups and oxy-1,2-propylene groups in the same molecule.

Treatment of Waste Pickle Liquor

U. S. Patent 2,939,763. *June* 7, 1960. *F. D. Cooper, assignor to Otto Construction Co.*

A process for producing iron carbonate and ammonium sulfate from spent pickle liquor.

SCIENCE FOR ELECTROPLATERS

(*Concluded from page* 73)

teresting to note that Curves 1 and 3, which represent solutions of similar original composition, but different time of electrolysis, indicate a greater mechanical strain for deposits from the fresh solutions, Curve 3, compared to the results obtained after a run of 140 hours, Curve 1.

The effect upon the adhesion of the deposit is ascribed by Jacquet to the factor of aging, or continued working of the bath. This condition he associates with the progressive enrichment of the solution in cuprous ions resulting from a partial discharge of cupric ions at the cathode: $Cu + Cu^{++} \rightarrow 2\,Cu^{+}$. In neutral solution the cuprous salt may hydrolyze, giving cuprous oxide: $2\,Cu^{++} + SO_4^{--} + H_2O \rightarrow Cu_2O + SO_4^{-} + 2H^{+}$. Deposits from slightly acid copper solutions contain cuprous oxide, a condition considered a contributing factor in the differences in mechanical strain for copper deposits from solutions with changing acid concentrations. The presence of cuprous ion was not tested, since such tests, it was noted, are difficult and uncertain.

Jacquet concludes from results obtained that, as a rule, a fresh copper solution will yield deposits possessing poor adhesion but, with aging of the solution, the mechanical strain of the deposit becomes less.

FREE DATA FILES

on the complete

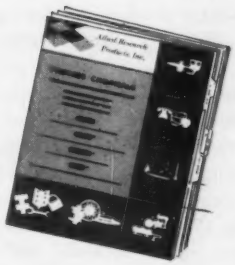
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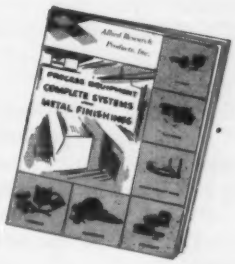
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FOREIGN LITERATURE

Characteristics of Hard Chromium Plate on Light Metal Cylinders and Re-Chroming of Worn Cylinders

P. Csokan: *Galvano* (Paris), **29**, No. 281, 346-348.

Investigational work conducted on large-scale production plating at Budapest, Hungary, has shown that the plate consists of layers of fine or coarse grains of chromium. Test observations have shown that the size and the density of the agglomeration are dominantly influenced by the current density applied. Examination has shown that a fine-grained structure of the coating is obtained with an operating current density of 50 amp./dm.^{2}. The structure of the chromium passes progressively into an increasingly coarser grain size with a current density of 65 amp./dm.^{2} and still more so at 80 amp./dm.^{2}.

In the coating which was obtained at 100 amp./dm.^{2}, crystalline projections were formed which rendered the coating rough and brittle under conditions of mechanical rubbing. Tests confirmed the facts given in the technical literature, that a medium-grain size hard chromium coating such as that obtained at 80 amp./dm.^{2} corresponds best to the required conditions of wear resistance as desired with i.c. engine cylinder bores.

The pores of the aluminum alloy, caused by the pickling treatment prior to plating, and which are only partially covered by the chromium, cannot be regarded as disadvantageous. On the one hand, the crystals which "grow into" the pores increase the adhesion of the coating and, on the other hand, the pore-pits, even those partly covered with the chromium, serve to act as micro-oil-reservoirs for lubrication. This serves to counteract the well-known otherwise bad wetting and lubrication properties of the coating. It has been found that artificial roughening, pitting, and channeling of the surface of the plate as usually practiced for engine cylinder bores which have been hard-chromium plated, is not necessary in this case. The pores in the aluminum alloy casting which are "developed" by the alkaline treatment and subsequent pickling in the mixed acid bath (hydrofluoric-nitric acids) prior to plating are entirely sufficient to satisfy the lubricating requirements.

Where a porous surface is required, such as with heavily stressed car engines (racing cars for example), it has been found that the anodic treatment of Vaulchier or Meyer given in the chromium bath, although it does produce a network of fine channels on the surface, has certain drawbacks. This is because it was found by the author that this treatment, with the current density used in hard chromium plating, causes a very irregular chemical attack on the edges of the cylinder bore, leading to rejects. The process, accordingly, was modified. It was found that a satisfactory procedure was to give a slight rinse with cold water after plating and then to conduct the anodic treatment for 1 to 2 minutes in 1-2% sulfuric acid with a current density of 30-40 amp./dm.^{2}. The density of the network of fine channels formed is influenced dominantly by the fine-grain structure of the chromium. Too dense a network of capillarly fissures is produced with too-fine a grain size, which can lead to a complete "wear" destruction of the grains in use. On the contrary, a coating with a medium-size grain structure, such as is that obtained with a current density of 80 amp./dm.^{2} at 60°C. permits obtaining a surface channeling system which is ideal from the viewpoint of lubrication; the surface does not disintegrate under conditions of use. The channels produced are generally so deep that their presence can be seen, even after honing.

The plating techniques have also been used extensively for the rechroming of worn cylinder bores. This has been found useful where the plating in the bore has been worn away or where it had become unusable because of defects. It is fairly well known that chromium plate cannot be deposited with any real certainty on an old coating. This old defective chromium must first be dissolved away completely and then rechromed after a preparation treatment corresponding to the basis metal surface. Methods proposed to dissolve the chromium given in the literature are not suitable here. The method adopted successfully by the author is to degrease in an organic solvent and polish mechanically; dry in a current of warm air; mount on the rack and then dechrome. The cylinders for repair are treated anodically at room temperature with a current density of 46-54 amp./dm.^{2} in very dilute sulfuric acid solution (10 g./l. plus inhibitor). Voltage control is important. It is only possible to rechrome each light metal cylinder once in this way, twice as a maximum.

Hard Chromium Plating of Light Metal Cylinders: Zinc-Dip and Non-Zinc-Dip Methods

P. Csokan: *Metalloberflaeche*, **13**, No. 3, 81-83.

Details are given of the hard chromium plating techniques developed and used at the Metal Research Institute, Budapest, Hungary for the treatment of engine cylinders of light metal. Plating of the light metal alloys is a difficult operation to conduct because the aluminum surface oxidizes rapidly in air and the adhesion of an applied electrodeposited coating of metal is adversely affected by the film of oxide. In the case of hard chromium plating, the adhesion is of paramount importance to the success of the operation. The technique employed to overcome this trouble is to apply a coating of nickel, manganese, iron or zinc by a chemical contact (dip) procedure. Precautions are taken to protect this coating to a reasonable extent from atmospheric action during the preparation for chroming. The chemical or electrochemical elimination of these metallic coatings just before the plating stage, leaves a surface condition which fulfills the required conditions.

Extensive practical experience obtained both under laboratory test conditions and large-scale production practice, has proved that the pre-coating treatment with a zinc metal film in a solution of alkaline zincate gives the most satisfactory results in practice. To some extent, this statement needs qualification. Careful observation made with the processing in recent years has shown that often, even the zinc-filming method was not absolutely perfect in application.

Research has shown that the defects in this case can be caused primarily by the metallic impurities in the contact bath (bismuth, arsenic, tin, lead in the zincate bath, for example). Also, the solution of the coating alloyed with these foreign metals, before the hard-chrome plating, is not uni-

form. The metal traces, which remain as a result of the formation of passive areas on the coating, serve not only to diminish the adhesion of the plated chromium coating but also have a further effect in influencing the physico-chemical and mechanical properties.

The electrochemical solution (anodic) of the zinc dip-coating causes a premature contamination of the chromium plating bath and the frequent bath make-ups which become necessary makes for an excessive consumption of chemical products and increase the processing costs. Research was conducted from the viewpoint of fulfilling the conditions of quality, of simplifying the technology of the process and of rendering the procedure more economic. The obvious necessity in this direction was to initiate and develop a processing method which permits direct plating on the light metals, without the usual intermediate dip-coating.

With this method the light-metal cylinder is treated as follows: Instead of zinc-coating and pickling in nitric acid, the part is dipped for 1-2 minutes in a mixed acid bath. This bath contains, in addition to a certain amount of water, hydrofluoric acid and nitric acid in a molecular ratio of 1:5. The temperature of the mixed acid bath is 12-14°C. (maximum 15°C.). It can be assumed that, by pickling in this mixed acid bath, a fluoride film of molecular thickness is formed at the aluminum surface. This film — particularly in the moist condition — completely prevents the oxidation of the aluminum surface for the time being.

Pickling in this mixed-acid bath is a strongly exothermic reaction and, as a result, the bath can warm-up appreciably within a short time. In this case, and unless it is prevented, instead of the uniform silver-gray metal surface which is formed, there can occur a coarse surface etching action, so that the surface of the part is then unsuitable for plating. To prevent this, it is necessary to carefully cool the bath. After pickling, the cylinders which are mounted on the racks and which have been preheated in a water-bath, are passed into the plating bath under current. The current is so controlled that the current density is as follows:

During the first five minutes: .. 35-45 amp./dm.^{2}
During the second five minutes: .. 45-65 amp/dm.^{2}
After the first 10 minutes to end of plating .... 65-80 amp./dm.^{2}

The chromium bath temperature is 60°C. The composition of the bath is that normal for hard plating. After plating, the rinsed and unracked cylinders are boiled for 1-1½ hours in pure water, to remove the bath residues occluded in the pores. This also releases the stresses in the coating. After this, the chromium shows a medium fine-grained, semibright surface. The special racking arrangements adopted give an overall uniform coating thickness in the bores. It has been found from experience that, for light metal engine cylinders, a coating thickness of 0.06 to 0.08 mm. is the most favorable.

Nature of Passive Coatings on Thin Nickel Films

H. Pfisterer and A. Politycki: *Zeitschrift Elektrochemie* (Germany), **63,** No. 2, 257-261.

Extremely thin nickel coatings, produced electrolytically and separated by chromic acid from a copper sub-surface, and which had become passivated as a result, were subjected to examination. In the electron diffraction diagram, besides the interference diagram of the nickel, the films showed the oxide. Even thin films only 20 Å thick were not completely through-oxidized after the chromic acid treatment.

An evaluation on the basis of simultaneous diffraction diagrams of various preparations, gave an average oxide coating thickness of 12 Å. No pores or cracks could be discerned in the oxide coatings, which consisted of single crystallites of 10 to 20 Å linear width, grown into one another.

Chemical Color Treatments on Copper and Copper Alloys

Kupfer Mitteilungen (Berlin, Germany): **58,** No. 7, 96-106.

With acid chromate solutions, light brown to golden yellow colors can be obtained. These treatments are assuming considerable importance.

Gold: 150 g. sodium dichromate, 20 cc. nitric acid (sp. gr. 1.42); 6 cc. hydrochloric acid (sp. gr. 1.19); 33 cc. sulfuric acid (sp. gr. 1.84); 0.75 g. wetting agent, 1 liter water.

Brown: 150 g. sodium dichromate, 20 cc. nitric acid (sp. gr. 1.42); 6 cc. hydrochloric acid (sp. gr. 1.19); 0.75 g. wetting agent, 1 liter water.

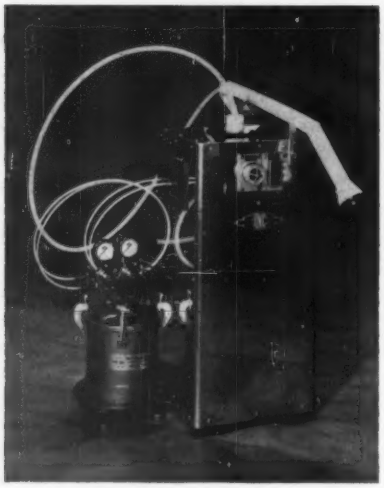
The treatment method is as follows: The coloring baths are used at room temperature. Glass vessels or enamelled pans are used as the containers. The brown color is obtained in about 1 minute and the gold color effect in around ½ to 1 minute. The parts to be colored must be moved gently and uniformly to and fro and waves and eddies in the bath should be avoided as this leads to a cloudy coloration. The coating obtained is sensitive in the wet condition. A cold and hot rinse is given and the treated parts are dried in a current of warm air.

With regard to the durability of the surface coloration obtained and the commercial aspects of the treatment, the following can be said. After drying, the coating adheres well. The bath is stable and is capable of producing a considerable amount of work before replenishment. The process is more expensive than coloring with liver of sulfur but is no more expensive than other processes.



Electrostatic Hand Spray Gun

Ionic Electrostatic Corp., Dept. MF, 111 Monroe St., Garfield, N. J.



A low cost, electro-centrifugal hand spray gun, model 10 is suitable for conductive, water base, and a wide range of standard paints without special formulation, it is claimed.

The new gun utilizes the principles of electrostatics to charge and guide preatomized particles of coating material. Atomization is mechanically secured by a combination of air and centrifugal force created by a high speed turbine. The many advantages of electrostatic deposition or wraparound, normally confined to automatic and stationary equipment, are now extended to a variety of jobs best painted by portable hand spray techniques, and to an infinite number of paints such as aluminum, copper, etc. normally not suitable for use by conventional electrostatic methods.

The spray gun has flexibility and versatility for all types and shapes of items to be painted, and applies conductive as well as non-conductive coatings. The same gun may be used for instantaneous color changes. It is available with normal straight head or with 45 degree angle head for hard to reach places as illustrated.

The power supply may be connected to any standard outlet. It is compact, safe and built to assure continuous economical, trouble-free operation. The hand gun weighs only 1¾ lbs. and is 35″ long; centrifugal atomizer heads are available from 2 to 4 inches in diameter. Power supply weighs 94 lbs. and is mounted on casters for portability. Dimensions are 17″ x 16½″ x 36½″. The unit operates on 115 volt, 1 phase, 50/60 cycle current. The model 10 unit is sold outright; no royalties are required.

Barrel Cleaning-Derusting Compound

Frederick Gumm Chem. Co., Dept. MF, 538 Forest St., Kearny, N. J.

A new, alkaline compound for cleaning, descaling and shine-rolling small steel parts, Clepo 11-T consolidates multiple cleaning, pickling and shine-rolling processes into a single operation. After tumbling steel parts for 15-45 minutes, the metal surfaces are completely cleaned and burnished. The work can then be water rinsed and barrel plated. This unique product thereby eliminates operations and reduces labor and material costs.

Alkaline Deruster

Turco Products, Inc., Dept. MF, 24600 S. Main St., Wilmington, Cal.

Called "Surj," this new product combines heavy duty cleaning abilities with light rust removing properties, for use electrolytically or as a soak tank cleaner. Because of its extremely high conductivity in solution, it cleans the surface of the work and penetrates deeply into the pores to remove, in addition to the rust, any grease, oil, buffing compound, or fingermarks present, leaving the chemically clean surface necessary for top quality, evenly distributed plating.

The solution requires no extra equipment. It can be used in either hard or soft water in mild steel tanks.

Deburring Compound

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

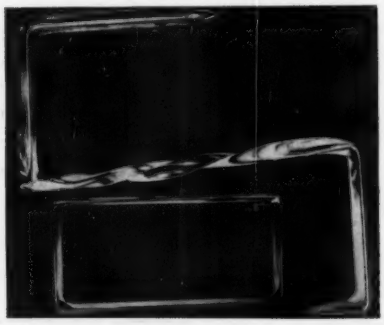
A new compound that combines moderate alkalinity with abrasives to deburr metals in tumbling barrels, FM 182 incorporates 40- to 80-mesh abrasive to speed cutting action, and so shorten deburring cycles in the finishing operation. It has no adverse chemical action on metals and, in fact, often enhances the color of the pieces. It may be used in a range of 4 to 48 oz./gal. of water, at room temperature, and for times varying with the nature of the work.

The material is particularly recommended for severe cutting down operations.

Leveling, Semi-Bright Nickel

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

A new sulfur-free, semi-bright nickel, Permalume can be continuously purified by carbon treatment without loss of addition agents. The deposit is highly receptive to subsequent deposits, it is claimed, and is particularly suitable as the undercoating below the manufacturer's newest bright nickel process, Levelume 220. The use



of a sulfur-free semi-bright undercoating with a full-bright top coating produces a duplex deposit with the highest corrosion protective properties obtainable.

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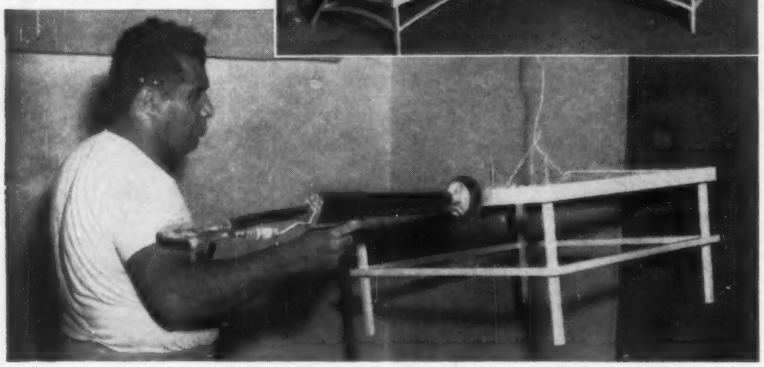
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Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

Instant liquid nickel chloride is advantageously used in place of dry nickel chloride. It offers nickel platers three advantages over the dry material; eliminates dissolving problems, ease in handling and better storage.

One gallon of the nickel chloride contains the equivalent of six pounds of the dry material. The material weighs 11.75 pounds per gallon, net, and is packaged in 50 gallon steel drums with a special corrosion resistant liner.

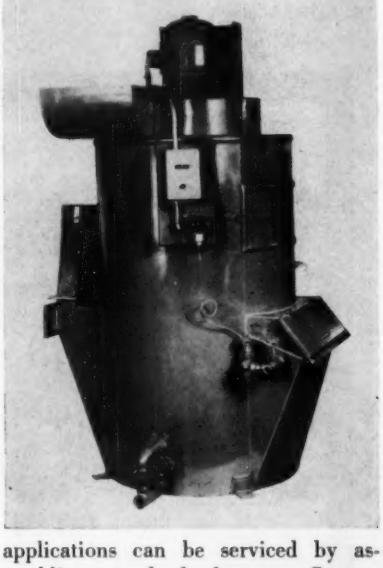
Dust Collector

Metal Fabricators Div., DeVilbiss Co., Dept. MF, Toledo, Ohio.

A wet type dust collector, with no moving parts and requiring minimum floor space, the Uni-Wash is made up of standard elements which can adapt to most installations, offering flexibility while retaining the cost advantages of standardization.

No pumps or agitators are used in the air-washing process. Instead it employs a unique principle for washing, scrubbing, and fogging contaminants out of the air stream and depositing them as a wet sludge for manual or automatic removal. The design enables the collector to be offered at a low initial cost, assures low operating costs and minimum maintenance.

With several models available, most



applications can be serviced by assembling standard elements. Custom units will be manufactured for unusual requirements.

Spray Cleaning Unit

DuBois Chemicals, Inc., Dept. MF, 1121 W. Front St., Cincinnati 3, Ohio.



The new "Jumbo Du-Zolver" holds and mixes 10 gallons of detergent at predetermined concentration into hot water pressure lines, producing up to 1600 gallons of cleaning solution. The solution can be sprayed over an area up to 20% greater than old style cleaning guns and sprayers have provided, it is claimed.

The unit has wheels and a handle so that it can be wheeled into any area where workmen walk.

Organic Coating Machine

Finish Engineering Co., Dept. MF, 921 Greengarden Road, Erie, Pa.

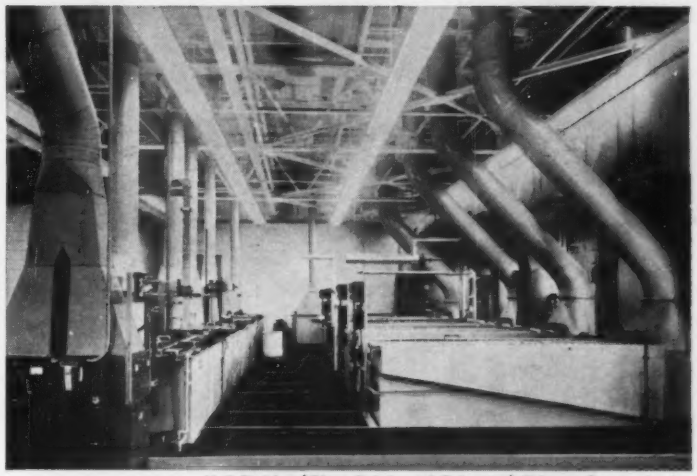
For prime and finish coating, baking, metalizing, especially for multiple-coat operations, this new machine is claimed to offer big savings.

Each part to be coated is loaded to a work-holder on a spindle. The spindles, instead of being attached to a moving chain, are on carrier rods independent of the chain. When a carrier rod is placed on the machine, 20 or 30 parts are loaded at once. Lifting off the carrier rod unloads all of these parts, and they stay on the rod through all stages — prime coating and baking, finish coating and baking, or metalizing. Rejects are greatly reduced in multiple-stage operations. There are no finger marks on parts wet with coating, because the parts are not handled but ride the rods.

When changing from one painting job to another, there is no down time with the new "Ride-the-Rod" machine,

HEIL of Cleveland

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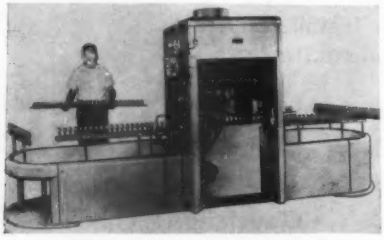


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268 Doremus Avenue, Newark 5, N. J. · 2014 East 15th St., Los Angeles 21, Calif.

as the operator attaches new work-holders to the carriers in advance, and has them ready for the change.

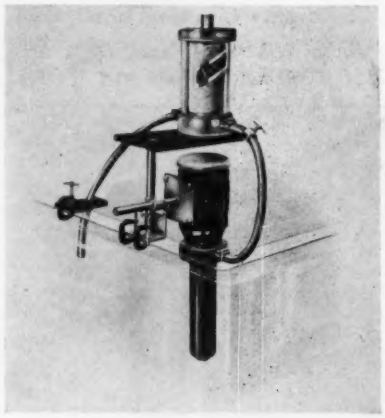
The machine can be used either with rotating or non-rotating work-holders. For long runs the parts can be loaded on the carrier rods automatically and coated at speeds up to 30,000 per hour. The machine's speed is adjustable from 200 to 600 carrier rods per hour. Speed of part rotation is also adjustable, independently of carrier rod speed. The machine is furnished with either dry type or waterwash spray booth.



'In-Tank' Filter Systems

Sethco Mfg. Corp., Dept. MF, 2284 Babylon Turnpike, Merrick, N. Y.

Designed for use in precious metal plating departments as well as research laboratories having small plating tanks, the completely new XAL 'In-Tank' filter systems with detachable full-view filter chambers, are completely trouble-free. There are no wearing parts and there is never any danger of aeration or of leakage. Thus, all the advantages common to both centrifugal and self priming filter systems are retained in the filter systems while their disadvantages are eliminated.



The pump is fabricated of high temperature epoxy resins, while the pump shaft is available in stainless steel 316, Hastelloy, titanium or epoxy. Filter chambers are available in high temperature lucite, epoxy, PVC or Teflon. Thorough depth filtration down to 1 micron is provided by filter tubes of cotton or Dynel. Also available are porous stone and porous carbon filter tubes.

Power for the pump is supplied by a ⅛ hp, 115 volt, Universal ball bearing motor.

The two models available at present are:

MODEL XAL-1, rated at 10 gal./hr.
MODEL XAL-5, rated at 50 gal./hr.

The pump itself which is the same for both models, delivers 250 gallons per hour on open pumping and develops a pressure of 11 p.s.i. at shut off.

Flow regulation is provided by compression of the vinyl hose, simply by means of a stainless steel pinch valve.

Toxic Solvent Dispensing Can

Protectoseal Co., Dept. MF, 1920 S. Western Ave., Chicago, Ill.

A new dispensing can for toxic solvents protects the user from accidental contact with toxic liquids used in cleaning and finishing operations, and eliminates the toxic vapor hazard by means of an automatic, self-sealing well. By preventing the solvent vapors from escaping into atmosphere, the can also reduces evaporation losses of expensive solvents.

To moisten a small swab or brush,



the user places it in the plunger type well and depresses the assembly with one or two fingers. This dips the brush into the solvent. Upon release of the spring loaded plunger assembly, the excess liquid flows back into the can and the liquid opening is re-sealed.

The cans have a wide, low base for maximum stability to prevent tipping and spilling of the contents. Terne plate construction provides a uniform, inside-and-out lead coating for resistance to corrosion. Standard finish is high gloss, solvent-resistant, baked-on yellow enamel. Colors other than standard are available to meet the requirements of individual plant safety codes. Liquid capacity of the can is ½ pint.

Tank Lining

U. S. Stoneware Co., Dept. MF, Box 350, Akron 9, Ohio.

The addition of Penton chlorinated polyether tank lining to its series of corrosion-resistant lining materials is announced by the above manufacturer. Providing outstanding corrosion-resistance even at elevated temperatures, the lining affords economical protection against virtually all organic and inorganic agents, resisting all inorganic acids except fuming nitric and fuming sulfuric.

Because of the high temperatures at which the material can be used, it fills the temperature gap between polyvinyl chloride and fluorocarbon but sells at a cost much lower than the latter.

Extruded in form roll, tank linings are installed by factory-trained applicators located throughout North America.

Polyester Resin

Chemical Div., Goodyear Tire & Rubber Co., Dept. MF, Akron, Ohio.

Tough, armor-like coatings have been developed from a new family of polyester plastic resins, claimed to have exceptional resistance to abrasion, ultraviolet rays, chemicals and weather. Other advantages of the new Vitel resins include excellent adhesion, clarity, electrical properties and the ability to bind pigment.



Hammond Dial Control Does It!

. . . Select proper wheel speed while head is running

. . . Various speed ranges available

Advantages

1 — **WHEEL ECONOMY:** As wheels wear speed is increased, giving maximum production and wheel life.

2 — **INCREASED PRODUCTION:** Select most efficient speed without stopping head.

3 — **BETTER FINISH:** Different materials require different speeds.

4 — **CONVENIENCE:** Metal chart on dial is your guide to the right speed for the job.

Write today for complete information!

Hammond Machinery Builders INC.

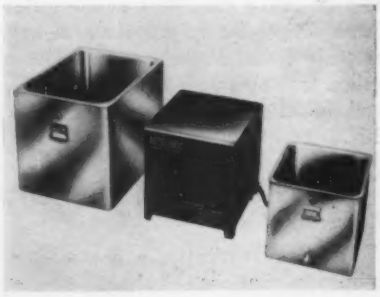
1601 DOUGLAS AVENUE KALAMAZOO, MICHIGAN

Self-Tuning Ultrasonic Cleaner

Powertron Ultrasonics Corp., Dept. MF, Patterson Place, Garden City, N. Y.

The Autosonic Series 1000 ultrasonic cleaners require no operator attention or tuning, and maintain optimum cleaning performance by means of an exclusive feedback transducer which electronically compensates for all varying load conditions, it is claimed.

The basic generator for the heavy duty cleaning system, the Model PA-10001, provides an average output of one kilowatt, with a four kw peak. It



When You Buy Silver Anodes . .



PAY FOR THE METAL
DON'T PAY FOR SPECIAL SHAPES

With Handy & Harman rolled anodes, you buy exactly what you need in length, width and thickness . . . your initial cost is lower and you've got less cash tied up in inventory.

Another Handy & Harman "added anode attraction" is the range of available finenesses. If you don't need extra fineness, you can specify exactly what you want, and get it. As always, standard requirements are fully met with Handy & Harman's 999 + FINE. And, you can specify any fineness above that grade for your particular needs.

We'd like very much to review with you your anode costs and show you how—with Handy & Harman rolled anodes—you buy the *metal* you need, *not* the shape.

When all is said and done

Handy & Harman's Refining Division is very much interested in your left-overs. Your silver plating solutions, sweeps, scrap and waste get the most *rewarding* attention when you send them to us. Accuracy with what is yours is the basis on which this service is offered. Address your next shipment to the nearest refining station listed below and profit thereby.

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General Offices: 82 Fulton St., New York 38, N. Y.
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EAST COAST			WEST COAST	CENTRAL U. S.
82 Fulton St. New York 38, N. Y.	Bridgeport 1, Conn.	425 Richmond St. Providence 3, R. I.	330 N. Gibson Rd. El Monte (Los Angeles), Calif.	1900 W. Kinzie St. Chicago 22, Ill.

is a compact, rugged, air-cooled unit 17″ long by 17½″ wide by 18″ high, operated by a single on-off switch. Multiple units may be combined in modular installations to give up to ten kilowatt operation.

Transducerized cleaning tanks of 8 and 32 gallon capacities in the series can be driven by the generator, as well as tanks from smaller systems. The 8 gallon tank measures 14″ x 14″ x 10″, and the 32 gallon tank is 24″ x 18″ x 16″.

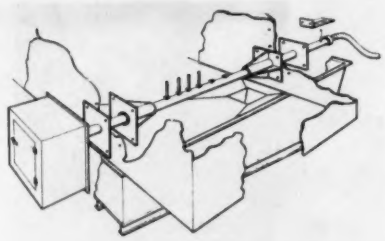
Flow Coater

George Koch Sons, Inc., Dept. MF, Evansville, Ind.

The Zahn oscicator, a flow coater, utilizes a time-controlled and stroke-controlled movement of only a few standard low-pressure nozzles, thus including the best features of both high and low pressure systems. The combination of these two motions flows the paint into all crevices and over all of the item's surfaces, according to the manufacturer.

Although this type of flow coating originated in Europe, it has met with equal success in the United States and conversion packages are being built to change old type flow coaters to this new one.

An important advantage of the unit is the minimum solvent loss that occurs — in many cases less than one gallon per operating hour. Thus, there



is little or no solvent odor leakage into adjoining work areas.

If color or material changes are necessary, power solvent flushing can be done in a few minutes, plus the time required for switching the two small material tanks, which can be portable. Color changing requires about thirty minutes, and the flushing solvent is reusable for future paint thinning, it is claimed.

The equipment is extremely compact, quiet in operation, of simple push-button type, and additional savings are realized by shorter tunnels and less floor space. Only a single operator is needed for total operations which include power washer, flow coater, solvent vapor tunnel and baking oven.

Gold Anodized Aluminum

Aluminum Co. of America, Dept. MF, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

A new finish for aluminum is a pale gold, bringing to 12 the number of color-anodized coatings now available for exterior use on architectural projects. Other shades include a companion dark gold, two hues of blue, four of gray, two browns, and two greens.

Excellent color retention is afforded by the new gold, it is claimed, since new alloys have been developed to achieve the color without the need for special pigment additives. Both sheet and extruded shapes are available with the new finish.

Mechanical properties of the new alloy are comparable to those of the popular 6063 alloy now used throughout the architectural industry.

High Boiling Solvents

Shell Chemical Co., Dept. MF, 50 West 50th St., New York 20, N. Y.

Two compounds which constitute a new class of chemicals and have a wide range of indicated uses as high boiling point solvents, increasingly

needed by the surface coating industry, are now being put into commercial production. The new developments are a keto-ether, called Pent-Oxone, and a glycol-ether, called Pent-Oxol. They combine the superior solvent properties of currently available ketones and glycol ethers. Films deposited from these solvents have excellent gloss and extreme smoothness, and thus need less rubbing.

The new products are strong solvents for such dissimilar resins as acrylic, vinyl, epoxy, urethane, and nitrocellulose. This unique quality will enable surface coating formulators to shave their costs by reducing the variety and volume of their solvent inventories.

Rust Preventive

Lehigh Chemical Co., Dept. MF, Chestertown, Md.

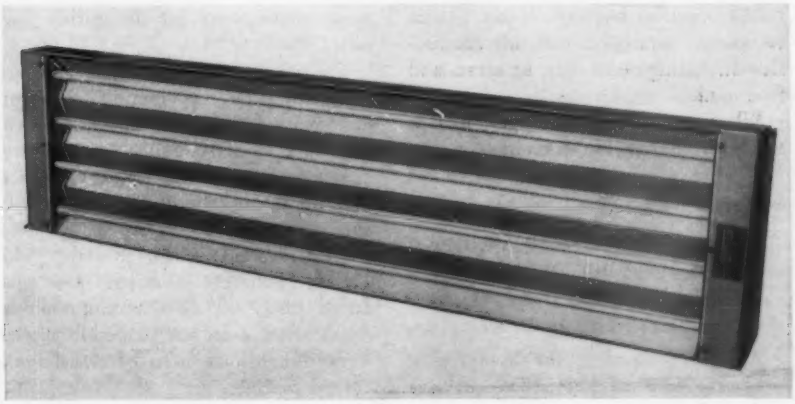
A superior water base rust preventive engineered specifically for indoor or shed storage, Anderol L-536 is a non-flammable, non-toxic preventive that employs polar type inhibitors to assure absolute protection from the elements. The thin oil film which is deposited is almost invisible and is completely compatible with all types of lubricants. Removal of this film is necessary only if the surface is to be painted or chemically treated.

The material can be easily sprayed, dipped or brushed on, and is available in 16 ounce spray cans, 1 gallon cans and 5 gallon and 55 gallon drums.

Quartz Heating Panels

The Cleveland Process Corp., Dept. MF, 1773 E. 21st St., Cleveland 14, Ohio.

These new panels contain one to four Clepcofused, quartz, radiant heating elements. They come in standard lengths 2′ to 6′ and from 4″ to 12″ in width. Wattage can vary to requirements. The infra-red heating element can be varied up to 1700°F.

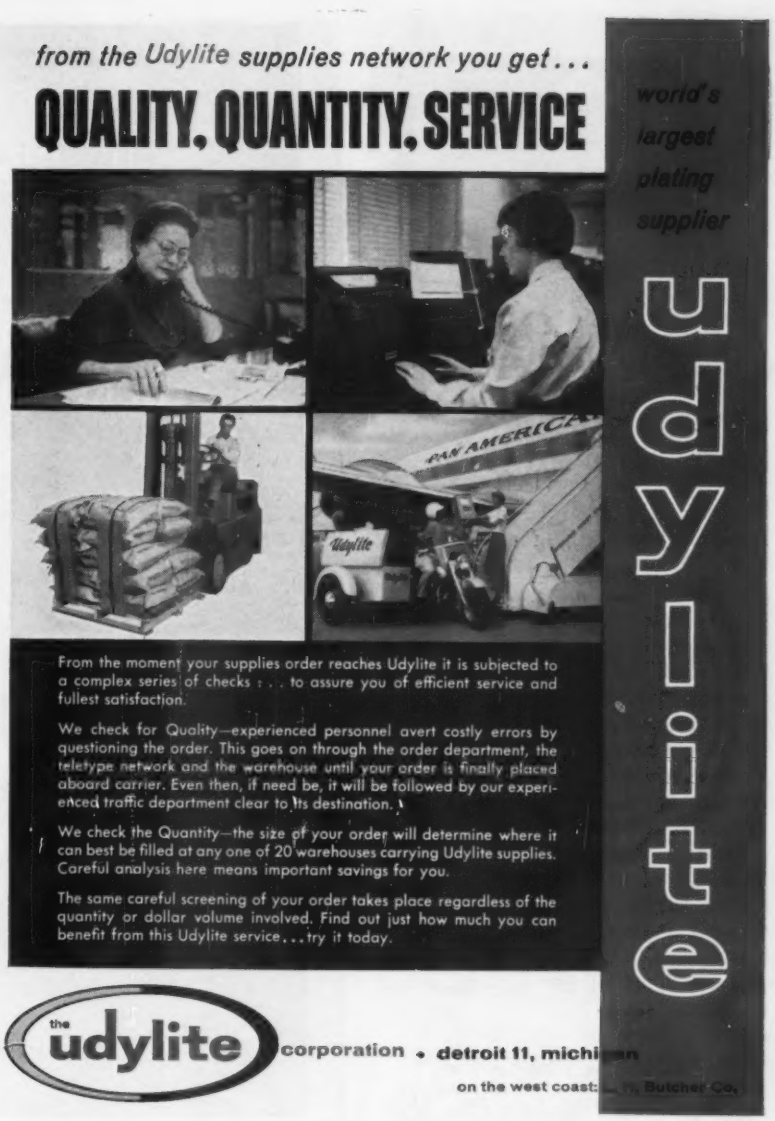


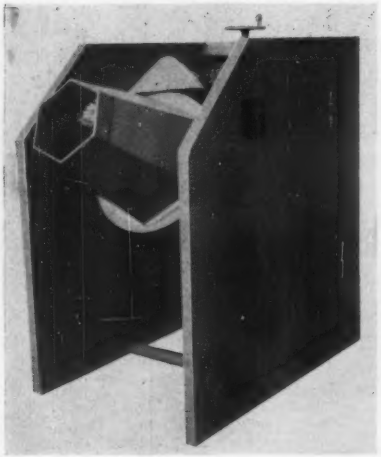
The aluminum reflectors are of the "snap-out" type and are backed up with 2″ insulation. Panels are surface angled to obtain even distribution of reflected radiation. Panel ends have ceramic standoff connectors with stainless steel studs and lockwashers and nuts and can be fitted in any oven. Panels and elements all have high thermo-shock resistance to vibration, acids or corrosion. Wiring conforms to National Electric Codes and J. I. C. standards. Installations carry a one year guarantee.

Tilting Barrel Finisher

Rampe Mfg. Co., Dept. MF, 14915 Woodworth Ave., Cleveland 10, Ohio.

The Model TC-IV precision barrel





finisher is a versatile, small-capacity machine with wide applications. It offers high precision results by combining an easy-tilting barrel with 19 to 44 rpm variable or fixed speed drive. The 1.1 cu. ft. capacity is ideal for small lots, pilot operations, or many special finishing jobs.

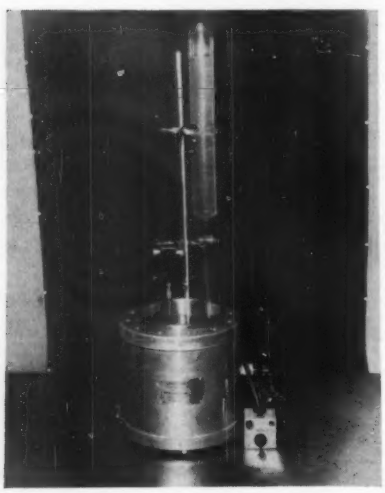
Barrels are available in open conical or closed hexagonal types, one or two compartments. All barrels measure 17" across corners and are orange "No-Seam" vinyl plastic lined by an exclusive process.

Standard controls include. ¼ hp, 110 volt motor, start-stop push-button, rugged welded construction throughout. Finished in Vista Green, the unit takes only 41" x 27" floor space and is 46" in height.

Electroless Plating Unit

Metal Processing Co., Inc., Dept. MF, 41 Canfield Road, Cedar Grove, N. J.

This laboratory and small production gold plating unit of 8 liter capacity was designed primarily for use with electroless gold solution. The tank is of stainless steel with an external electric heating jacket. It is completely equipped with all accessories, including controller, agitator, and feed tank.



When this unit is equipped with a second feed tank it is claimed to be ideal for use with electroless nickel solutions.

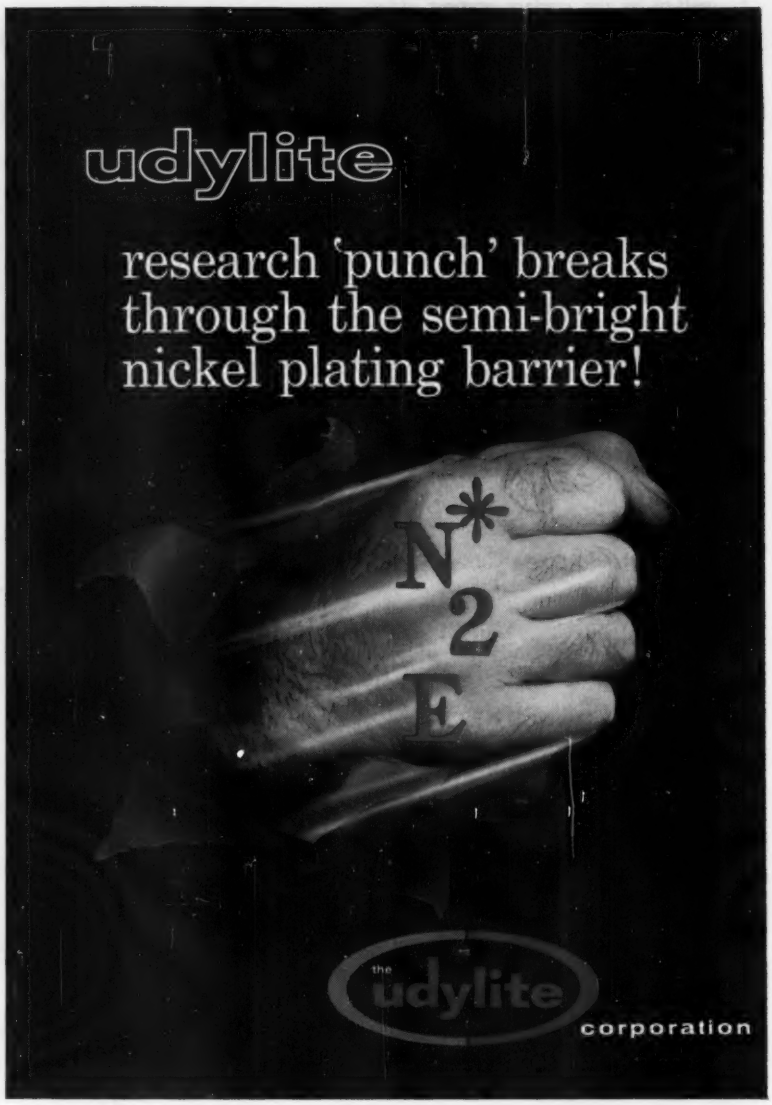
Chromate Conversion Coating for Aluminum

The Diversey Corp., Dept. MF, 1820 W. Roscoe St., Chicago 13, Ill.

A new compound for applying a chromate film to aluminum surfaces for protection against corrosion, Divercoat 2-A conforms to MIL-C-5541 specifications covering immersion coatings. It may be used as a base for paint coatings or for decorative purposes.

Chromate conversion coatings are produced simply by immersing aluminum work for a short time in a solution of 1 to 3 oz./gal. at room temp.

Depending on the alloy processed and operating conditions, the resultant conversion coating ranges in color from iridescent yellow to light gold. Tightly adherent coatings are produced easily on all aluminum alloys. Application does not perceptibly alter work dimensions, even of closely machined pieces.



✳ BRAND NEW PROCESS is easier to operate and control, provides better uniformity of color and greater production efficiency than ever before!

here's why:

NO HARMFUL BREAKDOWN PRODUCTS. There are no harmful materials formed from the N2E addition agents as a result of the plating process! Thus, batch treatment is necessary only when contaminants from other sources enter the bath and continuous carbon filtration will not remove them. The result is a substantial saving in solution, downtime, manhours and additional chemicals ordinarily required to treat and rebuild the plating bath.

CONSISTENT UNIFORMITY. N2E addition agents are noncritical in concentration. Reasonable variations from recommended concentrations will not seriously affect the characteristics of the deposit. Overall uniformity of color is maintained. Even in deep recesses on the backs of intricate die castings, amazingly clean deposits are obtained.

WIDE CURRENT DENSITY RANGE. N2E's average current density range is 30 to 60 amperes per square foot, with a considerably higher limiting current density. This wide range permits faster plating at a higher average current density without burning.

GREATER TOLERANCE TO METALLIC IMPURITIES. The absence of harmful breakdown products is of special importance in connection with metallic contaminants, since the undesirable effects of the two are cumulative. Another N2E 'plus' factor that helps maintain uniformity and quality.

ADHESION GREATLY IMPROVED. Production experience over a considerable period of time has conclusively demonstrated the excellent adhesion characteristics of Udylite N2E in combination with the Incomparable '66' Bright Nickel Process.

ECONOMICAL CONTINUOUS FILTRATION. One of the outstanding advantages of N2E is the fact that the bath can be continuously filtered through an activated carbon pack without appreciable loss of brighteners. The cleaning action of the continuous carbon filtration permits long periods of uniform, high quality production. The stability of N2E addition agents also permits economical bath purification by low current density electrolysis.

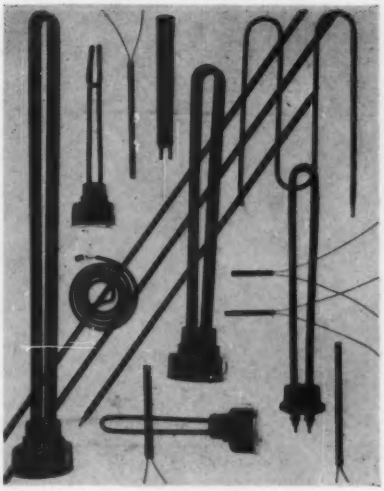
CAN BE ADDED DIRECTLY TO BATH. N2E addition agents are liquid and can be added directly to the bath without the use of filters. For high-speed operation, air agitation of the bath is recommended, although N2E performs well with mechanical agitation and can even be used without agitation.

See for yourself what N2E can do to improve your plating operation. Submit one of your problem parts for test plating now. See your Udylite representative. Or, write or phone:

world's largest plating supplier

udylite

detroit 11, michigan • on the west coast: L. H. Butcher Co.



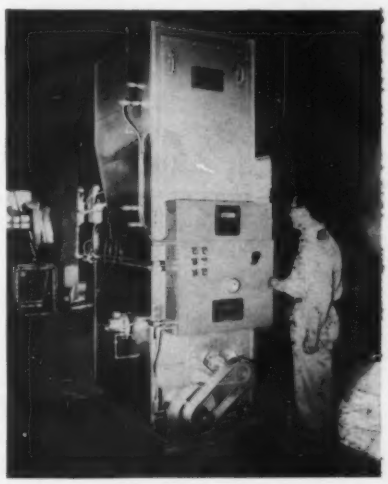
ers. The manufacturer also supplies control devices.

Solvent Fume Disposal

Catalytic Combustion Corp., Dept. MF, 4735 14th St., Detroit 8, Mich.

Utilizing unique metallic-supported catalysts to promote low-temperature oxidation or flameless combustion, this new unit converts noxious, combustible fumes, odors, and vapors from a variety of paint baking and drying operations to harmless, odorless, colorless carbon dioxide and water vapor. As the oxidation reaction occurs there is a release of the latent heat energy contained in the fumes. This clean heat is often available for profitable heat recovery.

A typical fume combustion unit is shown in the photo. It consists of an insulated sheet-metal housing containing pre-heat burner, catalyst elements, and exhaust fan, with attached control panel, all assembled as a single compact unit, ready for installation, push-



Floatless Liquid Level Control

The B/W Controller Corp., Dept. MF, 2200 E. Maple Rd., Birmingham, Mich.

A new high sensitivity electronic floatless level control has been developed primarily for use on applications involving liquids of medium to high specific resistance, up to 12.5 megohms. Designated Type 50-201, the versatile new control is said to incorporate several unique design features which make it readily adaptable to an extended range of installations.

The new control unit's low electrode potential, 9 volts D. C., and low electrode current of less than 1 milliampere eliminate all shock and sparking hazards. Operating characteristics are such that there is no possibility of product contamination due to electrolysis. And, for long distance applications, the system can be operated over leased telephone lines or other lead wires with the control unit located several miles away from the electrodes.

Electric Heating Elements

Heatrex, Inc., Dept. MF, 1274 S. Main St., Meadville, Pa.

The manufacture of a complete line of electrical heating elements has been announced by the above manufacturer. The full line includes these generic classes of heaters: immersion, cartridge, strip, tubular and switch heat-



PHELPS DODGE
dependable source of

COPPER SULFATE

NICKEL SULFATE

SELENIUM

TELLURIUM

- Carefully-controlled standards of purity and uniformity
- Orders filled promptly
- Material easy to handle in sacks and fiberboard drums

PHELPS DODGE REFINING CORP.
300 PARK AVENUE, NEW YORK 22, N. Y.

button start-up, and automatically controlled operation.

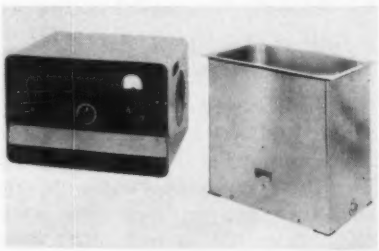
Ultrasonic Cleaning Unit

Ultrasonic Dept., Harris Transducer Corp., Dept. MF, Woodbury, Conn.

A new ultrasonic cleaning system, Sonex features a proprietary magnetostrictive transducer, comparable in principle to transducers developed for military applications.

Because of its exclusive strip construction, the new system withstands tank operating temperatures up to 300°F., gives continuous long life operation and is simple to maintain, it is claimed. Only 350 watts of power are required to activate a tank of five gallon capacity. The power generator required by the new system is simple, compact and provides trouble-free operation.

Standard parts, available at local repair shops, eliminate downtime problems almost completely. Because of the low voltage requirements, personnel hazards are small. The system operates at 22 KC for maximum efficiency at minimum noise level. Dimensions of the Model T500 tank (outside) are 15¾" long, 10¾" wide and 14½" high. Inside tank area is 14" by 9" by 9½". The generator, Model D350, is 19½" long, 15½" wide and 12½" high.



Electric Unit Heaters

Edwin L. Wiegand Co., Dept. MF, 7500 Thomas Blvd., Pittsburgh 8, Pa.

Smart appearing and compact in construction, these heaters have sturdy metal sheath Chromalox Fintube electric elements with built-in line voltage overheat protection. Wide fin spacing permits efficient, economical operation even in dirty atmospheres.

The fan motor is totally enclosed and also has built-in thermal overload protection. The fan is accurately balanced and is sized to maintain correct



relationship of air volume to final air temperature. A fan safety guard is standard on all models.

A roomy junction box is located on top of the phosphate treated heater housing shell for easy connection from overhead wiring. Adjustable, horizontal louvers give positive control of air flow in desired direction.

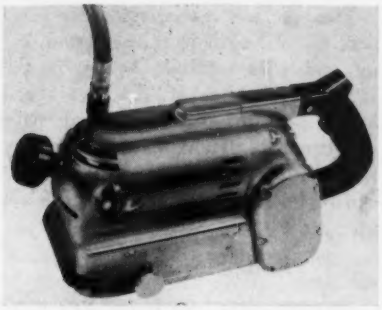
Ceiling mounting is accomplished by rod-type hangers. Swivel-type wall mounting brackets are optional. Daynite automatic control system is also available as optional equipment.

A wide selection of models offer heating capacities ranging from 17,065 Btu/hr to 85,325 Btu/hr. Power capacities range from 5 Kw to 25 Kw and 208 to 480 volts.

Belt Sander

Buckeye Tools Corp., Dept. MF, 5003 Springboro Pike, Dayton 1, Ohio.

A portable belt sander, equipped



with a burnout-proof air motor for finishing flat surfaces under continuous duty conditions, the 61E-783A has a 1.5 h.p. governed air motor that delivers and maintains a belt speed of 1120 sfpm under load. It is 16″ long, weighs 15 lbs., and drives a standard 3″ x 24″ belt.

Also made available is an air motor conversion kit for electric sanders of similar shape and size. The kit may be easily installed in existing tools.

Epoxy Coating

Carboline Co., Dept. MF, 32 Hanley Ind. Court, St. Louis 17, Mo.

A truly flexible amine-cured, epoxy protective coating system, Carboline Epoxy 188 is recommended for maintenance protection in severe acid, alkaline and salt exposures.

The coating is well suited to severe weathering exposures. Its good retention of flexibility means it will not stress-crack or set up severe stresses on the bond to the substrate. It can be applied over power-tool cleaned, as well as sandblasted surfaces, and is compatible with tight, residual epoxy coatings.

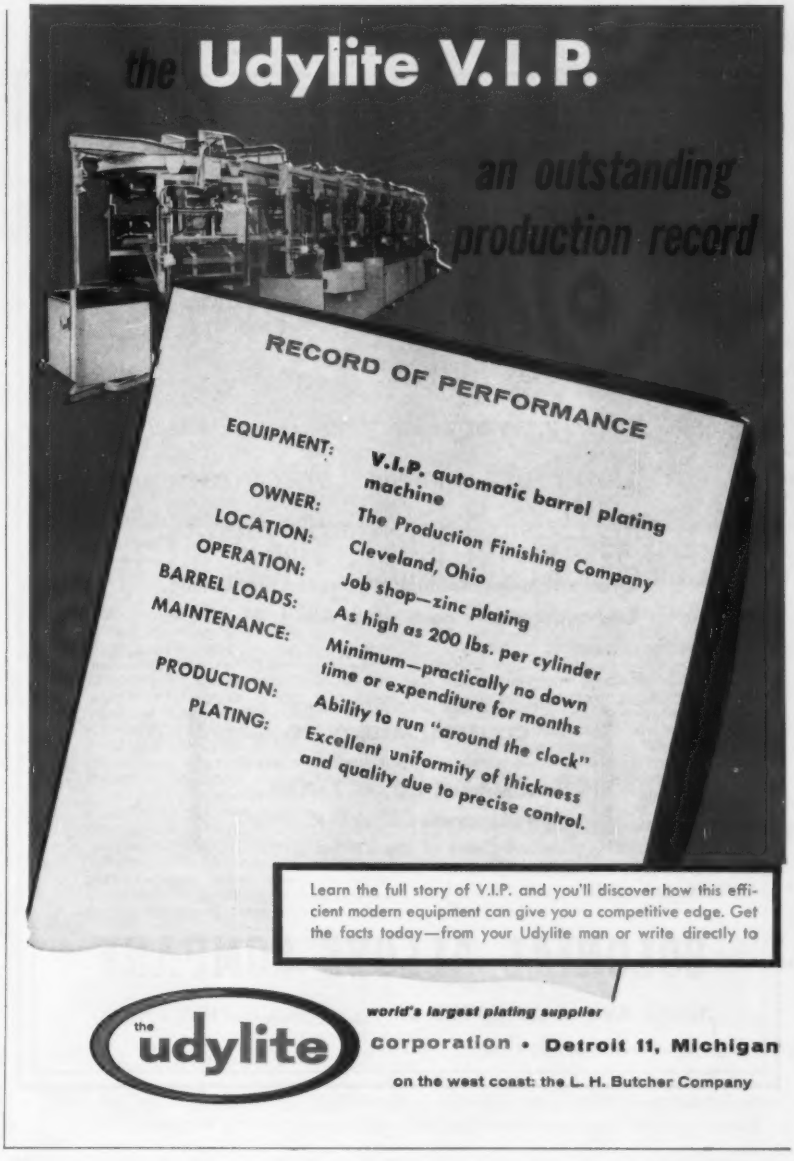
The material is applied at thicknesses of 3-4 mils per coat, nearly twice as thick as conventional amine-cured epoxies. It dries quickly, and in warm weather additional coats can be applied after two hours.

Olive Drab Dye for Anodized Aluminum

Sandoz, Inc., Dept. MF, 61-63 Van Dam St., New York 13, N. Y.

Aluminum Olive Green L is claimed to be a homogeneous anodizing dye with superior resistance to sunlight and heat fading. Due to these advantages it is said to be especially suited for olive drab shades on military equipment.

The dye may be used as a self shade or in combination with other dyes to produce a complete range of colors from olive green to khaki.



Marking Counter

Van D. Mark, Dept. MF, P.O. Box 44, St. Clair, Mich.

The Mark Counter drastically reduces the number of hours needed to take physical inventories, count stock in receiving, count out materials for shipment, and count in-process items at the inspection bench.

Operation is very simple. Each time a piece of material is touched with the pen tip, it leaves a small spot of ink and the counter clicks once. As a result:

The spot of ink readily identifies each item counted, and

The counter dial shows the exact number of items identified — and counted.



ALUMINUM BRIGHT DIP*
for
MIRROR BRIGHT SURFACES

Nearly everybody who uses an Aluminum Bright Dip employs this basic (Patented) method.*

Often eliminates mechanical polishing and buffing.
Brightens complex parts which cannot be buffed.

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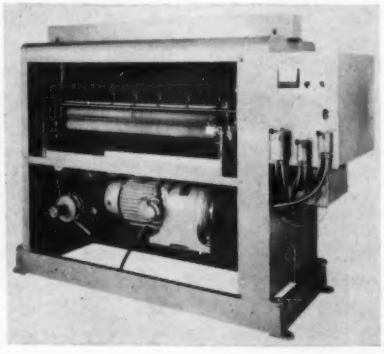
*U.S. Patent No. 2,729,551

Oscillating Sheet Polisher

Sales Service Mfg. Co., Dept. MF, 2363 University Ave., St. Paul 14, Minn.

The Tri-Matic sheet surfacer employs abrasive impregnated nylon mounted on an arbor which is adjustable to oscillate from 0 to 400 times per minute. The workhead drive can be equipped for single or variable speed and the feed rolls are equipped with variable speed drive. The work pressure is positively controlled and electrically metered to make it easy to maintain a constant pressure as the workhead wears and to repeat set-ups accurately.

The work may be supported by a billy roll that is stationary or electrically timed and either idler type or powered, or by a powered conveyor. The machine may be used singly or incorporated into a conveyor line.



The machine is available with practically any length workhead from 48" up and with multiple heads on the same work conveyor. The workhead arbor can be loaded with abrasive impregnated nylon material to any width up to maximum. The machine can be furnished for either dry or wet operation.

Plastic Spray Nozzle

Delavan Mfg. Co., Dept. MF, West Des Moines, Iowa.



A new plastic industrial spray nozzle is manufactured of polypropylene, said to be the lightest of current thermoplastic resins. It is extremely durable and offers unusual heat resistance.

From a design point of view, the nozzles are specifically engineered to eliminate clogging. There are no vanes, cores or other obstructions in the nozzle. All inside surfaces are smoothly rounded to eliminate the build-up of mineral deposits inside the nozzle.

Corrosion Preventive

Nalco Chemical Co., Dept. MF, 6216 W. 66th Place, Chicago 38, Ill.

Spray application of a new liquid corrosion inhibitor, called RP 252, is said to be highly effective for protecting metals from rust and corrosion during open shipment and outdoor storage.

Beyond improved protection, other benefits reported include ease of application and removal, absence of residue that previously interfered with welding and painting, and substantially less need for oil-absorbent floor compound in the spray area.

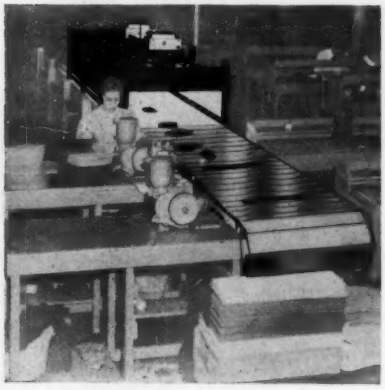
Thixotropic in nature, the product is a virtually colorless, odorless material that spray coats efficiently and gels on contact with metal. When the metal is ready for further fabrication, re-

moval of the inhibitor is said to be easily accomplished with a mild alkaline wash.

Infra-Red Conveyor

Mercury Industries, Inc., Dept. MF, Hillsdale, N. J.

An infra-red precision built conveyor for heat conditioning, setting and drying, features an all aluminum durable alloy conveyor with oven temper-



atures to 500°F. This is a strong easily assembled pre-fab with exclusive acid-resistant, corrosion-resistant, and rust-proof qualities. The controlled reflective heat offers high production and economical operation. Other special design specs are: vibrationless movement, variable speed, reversible controls, cleats for incline operation, and speeds to 100 fpm. Standard 5′ sections are available with heights and widths to meet any plant requirement.

Exhaust Blowers

Bayley Blower Co., Dept. MF, 1817 S. 66th St., Milwaukee 14, Wis.

Key to the new BC blower is the fan wheel structure which features a deepened inlet cone and all welded, backward curved, spun wheel shrouds. This design for both single and double width wheels also allows for finer tolerances between stationary and moving parts. Benefits derived from the new features provide for lower rpm with equal capacities, resulting in less hp per volume of air moved.

Efficiency is increased by several per cent, while fan noise is reduced considerably over all previous designs. Along with lower initial cost, other benefits include versatility, due to rotatable housings up to size 625 and split housings for easy wheel removal on larger sizes.



MEET THE PEOPLE BEHIND THE PACKER-MATICS

More, much more than the customer usually realizes, goes into a Packer-Matic automatic polishing or buffing machine to assure the production and performance guarantees that Packer is famous for. Over a period of 27 years we have established manufacturing standards which we believe to be the most demanding in our industry. This applies not only to those machine elements we ourselves manufacture but . . . equally important . . . we have built a series of reliable sources for purchased components that know we accept only the best they can produce.

Perhaps the best example of Packer-proved quality is the testing to which all completed machines are subjected before shipment. Continued inspection checks along the way are simply not enough. Every Packer-Matic is operated under customer-specified conditions before it leaves our plant. When the machine is received by the customer it's ready to go . . . without time-consuming adjustment and expensive delays. Packer-Matics are never "finished on the customers floor." A good point to remember when you are in the market for new equipment.

T. P. Stiles

Faced with a polishing, deburring, buffing or mechanical cleaning problem? Send sample parts, specifications and prints for free test evaluation . . . or write for free descriptive literature.


Model No. 1 Straight Line Conveyer


Model No. 14-45 Continuous Rotary


Model No. 13-10 Rotary Indexing


Model No. 4-5 Rotary Indexing

THE PACKER MACHINE COMPANY • 456 CENTER STREET • MERIDEN, CONN.
PIONEER MANUFACTURERS OF AUTOMATIC POLISHING AND BUFFING MACHINES

The line of fans ranges from 344 to 725,840 cfm, from one-quarter to six inches static pressure. Mechanical efficiencies up to 86 per cent have been obtained, with static efficiencies reaching 82 per cent.



Included in the list of accessory items are variable inlet vanes for volume control, inlet guard screens, access doors and housing drains, outlet dampers for volume control, cooling wheels, vibration bases and belt guards, and weather hoods. Special applications that require coatings and linings, spark resistant construction, or special materials can also be met by modifications to the BC line.

Several types of bearings are available. Ball bearings are standard for most applications. Grease-lubricated types are used at normal temperatures, oil-lubricated types or water-cooled

DAVIS-K
GOLD PLATING
SOLUTIONS

. . . LEADER in
Electrolytic
Precious
Metals!

DAVIS-K An Authorized Distributor Of SEL-REX
PATENTED
KARATCLAD
ACID BRIGHT GOLD PLATING PROCESS
FOR DECORATIVE APPLICATIONS

DAVIS-K QUALITY PRODUCTS:
- ONE OPERATION Antique Gold Solution
- ONE OPERATION French Grey Solution
- POTASSIUM GOLD CYANIDE SALTS
- LUSTROUS WHITE RHODIUM SOLUTION
- Variable-type Tank Rheostats, specially designed for precious metal plating.

ALL DAVIS-K GOLD PLATING SOLUTIONS ARE:
- Made in all colors
- Color constant
- Tarnish-resistant
- Brilliant in finish
- Bottled by Troy Weight
- Made from U. S. Treasury Gold only
- Ready for immediate use

We are fully equipped to reclaim old gold and rhodium solutions. No charge for small sample plating.
Write Dept. MF for details.

FREE Consultive Service
Call on Davis-K process engineers for help with your special plating problems and installations.

"Where Glittering Elegance Reflects Lasting Quality."
100% PURE GOLD DKP SOLUTIONS
DAVIS-K PRODUCTS, CO.
135 West 29th St., New York 1, N. Y.
LOngacre 4-1978 9

sleeve bearings for higher temperatures. Other special types are also available to suit specific conditions.

Wheel diameters are from 12¼", single inlet, single width, to 132½", double inlet, double width.

BUSINESS ITEMS

Ruco Becomes Division of Hull

Effective July 1, 1960, *Ruco, Inc.* of Dayton, Ohio has become a division of R. O. Hull & Co., Inc. To further service customers throughout Southern Ohio, warehouse facilities in Dayton have been increased. In addition, the firm is setting up a complete service laboratory to be staffed by a full time laboratory technician. Any problems of this nature can now be handled locally.

Roy Crichfield, who is well known in the Dayton and Cincinnati areas as a Hull representative for many years, will be the vice-president and general manager of the new division.



Roy Critchfield

R. J. Foresman Named Vice-President by Michigan Abrasive Company

R. J. Foresman, veteran coated-abrasives executive, has been named a vice-president of *Michigan Abrasive Co.*



R. J. Foresman

For many years, Foresman was vice-president and director of Midwest Abrasive Co., Owosso, and more recently served as vice-president in charge of sales and marketing of American Lincoln Corp., of Toledo.

Irving M. Sobin Chem. Co., Inc., Named Distributor by Shawinigan Chem. Ltd.

The appointment of *Irving M. Sobin Chem. Co., Inc.* of Boston as sole distributor of liquid and solid sodium cyanide in the United States has been announced by *Shawinigan Chemicals, Ltd.* of Montreal.

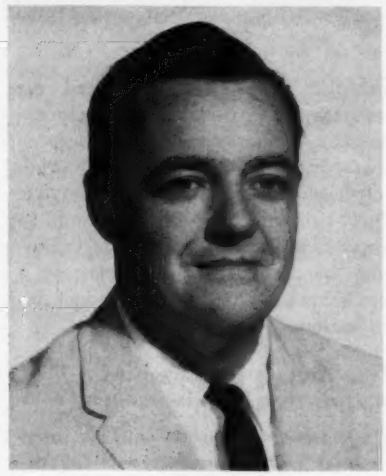
Coincident with the above announcement, Sobin has appointed *R. C. Brumberger*, formerly of Nuodex Products Co. and well known in the plating trade, who will concentrate his efforts toward national domestic distribution. Mr. Brumberger, a member of the Newark Branch AES, will have headquarters in Short Hills, N. J., and will handle other items of the firm's line

which are in demand by the metal finishing industry.

Oakite Names Holland Automotive Division Head

John B. Holland, of Birmingham, Mich., has been appointed Automotive Division manager of *Oakite Products, Inc.*, pioneer manufacturers of specialized chemicals for metal cleaning and surface treatment.

Mr. Holland comes to the firm after thirteen years with the Ford Motor Co., where he was production engineer, and four years with General Motors. He was educated at Wayne University



John B. Holland

and Detroit College of Applied Sciences. He will make his headquarters in the General Motors Building in Detroit, but will travel extensively to other automotive centers.

Hooker Improves Caustic Packaging

Providing many benefits for flake and screened caustic soda users, a new and improved, non-premium, full open-head steel drum of 400-450 pounds capacity has now been made standard by the Eastern Chemical Division of *Hooker Chemical Corp.* The new container replaces the 18-inch opening friction cap drum which the firm was first in the industry to supply as a non-premium standard package for caustic soda. The new 34½ by 21-inch, 49 - gallon - capacity, 24-gauge drum weighs about 20 pounds.

Post Forms Custom Abrasive Products Co., Inc.

Benjamin F. Post, former research and development engineer in the abrasives field, has announced the formation of *Custom Abrasive Products Co., Inc.*, with offices at 373 W. State St., Trenton, N. J. Created for sales and technical services to the metal finishing trades in the Middle Atlantic and New England states, the company will specialize in barrel and vibratory finishing media and compounds as well as pressure blasting abrasives.

The firm will not sell equipment, but will concentrate on applying scientific knowledge of the limitations, advantages and applications of various media and compounds to the fields of metal cleaning, coloring, preparation for plating, and finishing of castings, screw machine products and stampings.



Benj. F. Post







Sidney Fuhr

Cortez Chemicals Co. Expands

New warehouse and manufacturing facilities, now under construction at 734 E. Southern Pacific Drive, Phoenix, Ariz., for the *Cortez Chemicals Co.*, were scheduled to be completed in the near future. The building, 140 by 50 feet in size, adds 7,000 square feet of space for the production of agricultural specialties, industrial cleaners and compounds, water and sewage-treating chemicals, and chemical specialties for the electronics industry.

The company, a division of Arizona Fertilizer and Chem. Co., is engaged in a $200,000 expansion program. Immediately upon completion of its new warehouse and manufacturing facilities, the company will begin construction of the second unit in its expansion program, a new headquarters building which will contain office space and research and development laboratories.

Gumm Chemical Appoints Fuhr

It has been announced by the *Frederick Gumm Chem. Co.* that *Sidney Fuhr* has been appointed as its technical sales representative covering Northern New Jersey. His office will be at 538 Forest St., Kearny, N. J.

Mr. Fuhr attended City College of New York and the Polytechnic Institute of Brooklyn where he majored in Chemical Engineering. His practical experience includes almost ten years of production supervision in the metal finishing field. He then joined the company as assistant to the technical director where, for the past seven years, his time was devoted to product development and customer service. This comprehensive background in metal finishing will enable him to provide the customers in the territory a maximum of service and product information.

PPG Announces Licensing of Duracron Development

Licensing agreements with six international paint manufacturers for the production and distribution of its Duracron thermosetting and Duracryl thermoplastic resins in the world market have been announced by *Pittsburgh Plate Glass Co.* The arrangements were made by the company's international division, *Pittsburgh Plate Glass International S. A.*

The foreign licensees are: *Badische & Anilin Soda Fabrik (BASF)*, Germany; *Styrene Co-Polymers, Ltd.*, and *Lewis Berger, Ltd.*, both of Great Britain; *Lewis Berger and Sons Proprietary, Ltd.*, Australia; *Lewis Berger and Sons, Ltd.*, of New Zealand; and *United Paints Ltd.*, South Africa.

The agreements cover patents, technology, and rights to produce and market the products in Great Britain, the European Common Market, Australia, New Zealand, South Africa and certain other countries.

Cleveland Process Corp. Appoints Western Sales Manager

Cleveland Process Corp. announce the appointment of *D. P. Dorman* as Western sales manager. The western offices are located at 721 No. La Brea



D. P. Dorman

Ave., Hollywood 38, Cal. For the past three years, he was a sales representative for the firm in Southern California.

Mr. Dorman received his engineering education at the college of the City of Detroit and entered the business world serving the automotive industry in that city.

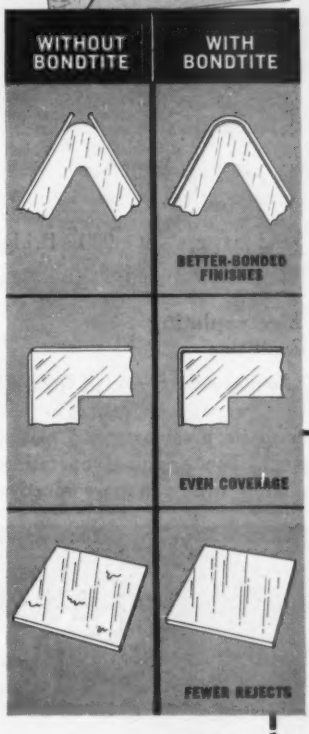
As a Los Angeles resident for 26 years, Mr. Dorman has had varied experience as shop superintendent, application and product engineer, instruments designer and production engineer in various industries.

H-VW-M Increases Grand Rapids Chemical Capacity 300 Per Cent

J. C. Miller Division, *Hanson-Van Winkle-Munning Co.*, has announced the completed expansion of its manufacturing facility in Grand Rapids, Mich. By the addition of reactors, filtration equipment and mixing equipment, the company has increased the monthly production capacity of the plant by a factor of three. The new facility went into limited production recently.

Grand Rapids has also been established as a new shipping point for nickel anodes. Complete processing operations are conducted at this plant, insuring prompt delivery.





PHOSPHATIZING WITHOUT PROBLEMS...

Now, at last, you can have the better-bonded finishes which can be achieved by phosphatizing, *without* the high costs . . . the troublesome, time-wasting testing . . . and the production-line tie-ups which haunt most phosphatizing operations. The reason . . .

NEW

MAGNUS BONDTITE

Magnus Bondtite is the really different phosphatizing compound which *maintains a constant pH* in virtually any normal concentration strength . . . making better-bonded paints a reality for shops of all sizes.

- **Low-cost**
- **Trouble-free**
- **Even safe for steel tanks**

MAIL COUPON FOR FREE INFORMATION

magnus 11 South Avenue, Garwood, N. J.

Please send free brochure describing the Bondtite phosphatizing method.

NAME _____

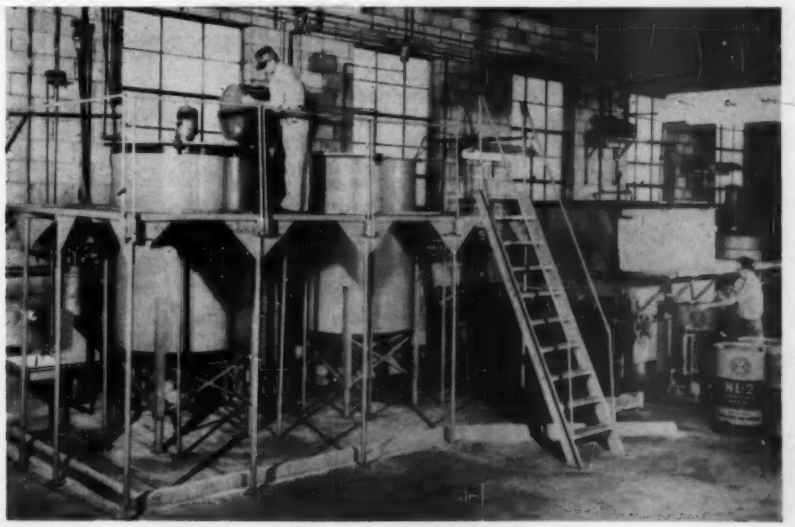
COMPANY _____

POSITION _____

ADDRESS _____

CITY _____ STATE _____

A WORLD-WIDE ORGANIZATION SPECIALIZING IN THE CLEANING AND PROTECTION OF ALL SURFACES.



Seymour Manufacturing Co. Appoints Stuart

Seymour Manufacturing Co., Seymour, Conn., has announced the appointment of *George N. Stuart* as works manager.

Mr. Stuart comes to the firm with

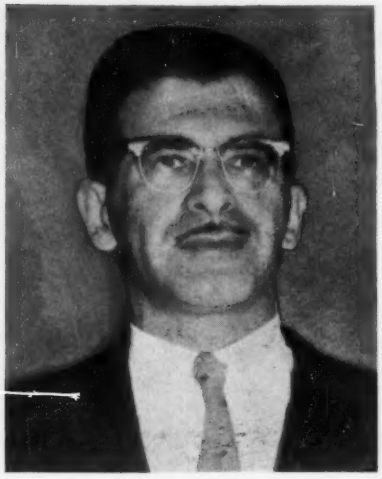
many years of experience in industrial management. From 1933 to 1947 he was associated with the Chrysler Corp., Chevrolet Motor Division of General Motors, The Western Cartridge Co., and with X-Ray, Inc., Detroit, where he was vice-president and general manager.

In 1947 he joined the Olin Mathieson Chem. Corp. and held several executive positions with the company in New Haven. In 1955 he became plant manager and production manager of the company's plant in East Alton, Ill., where he served until joining Seymour this year.

Mr. Stuart attended the Detroit Institute of Technology in his home city and is a graduate of the University of Michigan. He holds membership in the American Society of Mechanical Engineers and the Tau Beta Pi honorary engineering society.



John W. Weitzel



I. Friedman

Weitzel Joins Heatbath

Heatbath Corp. announces the appointment of *John W. Weitzel* as technical sales representative in Eastern Pennsylvania, Delaware and Maryland. Mr. Weitzel is a graduate of Saint Joseph's College and was formerly associated with Diversey Corp. He will have headquarters at 930 Bridge St., Philadelphia 24, Penna.

E. C. Electroplating Adds Facilities

E. C. Electroplating, Inc. of Garfield, *N. J.*, has recently completed a new addition to its precious metal plating department. The principal operations of this facility will be to more effectively service the electronic industry. This new 5,000 sq. ft. unit will house production, laboratory and inspection facilities. *I. Friedman*, technical director, heads the staff of this department.

Timesaver Sanders Names New Sales Manager

Timesaver Sanders, Minneapolis, Minn., recently named *L. S. "Bert"*



FUME ELIMINATING SYSTEMS . . .

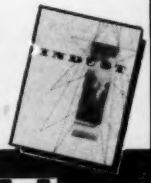
DESIGNED, FABRICATED AND INSTALLED BY INDUST ENGINEERS

- **CUT COSTS . . .**
- **LOWER MAINTENANCE**

Custom engineered to meet your special requirements for resistance to corrosive acids or alkalies, high temperatures and structural strength.

Standard sizes of reinforced plastics hoods, tanks, ducts, elbows, stacks and piping are stocked for spot shipment.

Write for complete information.



INDUST

4025 BERGEN TURNPIKE, NORTH BERGEN, N. J.
DIVISION OF INDUSTRIAL SHEET METAL WORKS



L. S. Sternal

Sternal as the company's sales manager.

Mr. Sternal has an extensive background in the coated abrasive and finishing industry. He spent 12 years with Minnesota Mining as a methods engineer, and 7 years as sales manager of the Jackson Buff Corp., New York. Most recently, Mr. Sternal held a sales management position with the Coated Abrasive Division of Armour & Co.

Corrosioneering, Inc. to Represent Ceilcote

Ceilcote Company has announced the appointment of *Corrosioneering, Inc.* as sales representatives for both North and South Carolina. The Charlotte-based firm will handle a complete line of corrosion-proofing materials.

Corrosioneering, Inc. is headed by *James H. Barnett* with offices located at 1909 Wensley Dr., Charlotte, N. C.

Enthone to Distribute Technic Products

Enthone, Inc. has been named distributor for the full line of precious metal plating products of *Technic, Inc.*, one of the largest producers and sellers of solutions for gold, platinum, rhodium, and palladium plating.

The new arrangement offers customers of Technic and Enthone the combined service facilities of the scientific and engineering staffs of both companies.

Thomas Now With U. S. Stoneware

Noel M. Thomas has joined *The U. S. Stoneware Co.'s* Plastics & Synthetics Division and will handle inside sales and sales correspondence of the Akron, Ohio, firm's Tygon flexible plastic tubing.



Noel M. Thomas

A graduate of Kent State University, Thomas was previously with the International Sales Division of The B. F. Goodrich Co., handling sales correspondence concerning rubber and synthetic hose, tubing, belting and similar industrial products.

Rhodium

ELECTROPLATING SOLUTIONS

Backed by 59 Years of Specialization



Rhodium electroplate is suggested for these applications: on wave guides and microwave equipment which may be used in marine atmosphere; in printed circuits; in electrical contacts where light contact pressure and low voltages are involved... Rhodium is very hard and corrosion-resistant.

This Rhodium plating solution is easy to use. It operates over a wide range of temperature and current densities. We will be glad to plate samples without charge.

SINCE 1901

Consult our staff about plating problems.

SIGMUND COHN MFG CO., INC. — 121 SOUTH COLUMBUS AVE. MOUNT VERNON, N.Y.

Luster-on

ECONOMICAL PROTECTIVE COATINGS FOR BRASS, ZINC, CADMIUM, COPPER, ALUMINUM

The Chemical Corporation offers a complete line of uniform-controlled chromate conversion coatings that provide maximum protection in one, low-cost, simple operation. Available for immediate delivery as liquid or powder.

Always Specify Luster-on —

FOR BRILLIANT CORROSION-RESISTANT FINISHES . . .
rivaling chrome for many applications where cost is a factor. Long-lasting, easily controlled application.

FOR CLEAR, BRIGHT and IRIDESCENT COATINGS . . .
gives striking, attractive appearance with complete corrosion-protection . . . even when humidity and handling are involved during processing. Also yellow iridescent and olive drab for concealed parts or as a paint bond.

FOR DECORATIVE COLOR . . .
on low-cost zinc. Brilliant golds, yellows, blues, greens, violets, reds, brass and copper hues.

FOR ALUMINUM . . .
where surface hardness is not of prime importance. Excellent finish for paint bonding.

FOR LASTING BRIGHTNESS . . .
on both copper and brass without noxious fuming.

FOR DIE-CASTINGS . . .
one quick dip provides uniform finish, ideal as a base for painting.

We'd like to show you what Luster-on can offer you! Send in sample part today for free processing. Data sheets on request.

Luster-on . . . the first and still the finest in conversion coatings.

The Chemical Corporation

58 Waltham Ave., Springfield 9, Mass.

British Firm Licensed by Technic

Silvercrown, Ltd., London, England, has been licensed to manufacture and sell the complete line of Technic precious metal plating products, with exclusive rights to manufacture in England for sale in England, the Commonwealth, except for Canada, and throughout Europe.

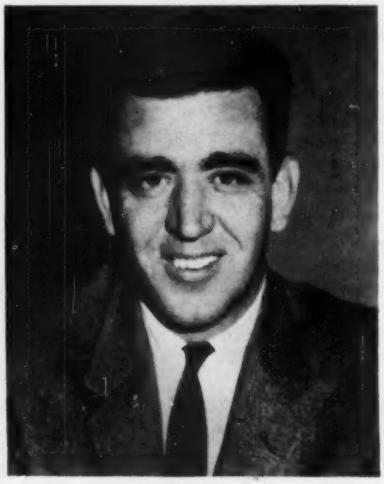
In addition, *Dr. Ing. Max Schloetter*, headquartered in Geislingen / Steige, has been sublicensed to sell in Germany the Technic products made in England.

The British firm is one of Europe's largest producers of electroplating equipment and materials for industrial, defense, and decorative use. Dr. Schloetter's firm distributes its products through most of Germany.

North American Mogul Prod. Co. Announces Appointments

North American Mogul Prod. Co., Cleveland, Ohio, industrial water treatment specialists, announces the appointment of *William T. Sull van* as director of marketing and general sales manager; and *George P. Loomis, Jr.* as director of service and product research & development.

Mr. Sullivan has served as Central Region sales manager since 1957. Prior to his present association he was district sales manager for Nalco Chem. Co. He received his Bachelor of Science Degree in 1952 from Indiana University and later attended Baldwin Wallace College. He is a member of American Water Works Association, Technical Association of Pulp and Paper Industry and the Sales Executive Club of Cleveland.



William T. Sullivan

there is a

STEVENS LIQUID TRIPOLI

for every buffing job!

HERE ARE THREE LEADERS:

27-L

COLORING COMPOSITION

A superior buffing compound for aluminum or any non-ferrous metal requiring extremely high color. Consistent, economical performance lowers costs, reduces rejects.

44-L

FASTEST-CUTTING TRIPOLI

Emulsion-type compound that sets record for pieces buffed per cwt. on all non-ferrous die castings, brass and aluminum.

59-L

ALL PURPOSE CUT AND COLOR TRIPOLI

Combines fast cutting characteristics with fine coloring qualities on all non-ferrous metals. Offers top total economy on the job.

Write for your copy of Stevens' new folder on liquid buffing and coloring compositions!



FREDERIC B.

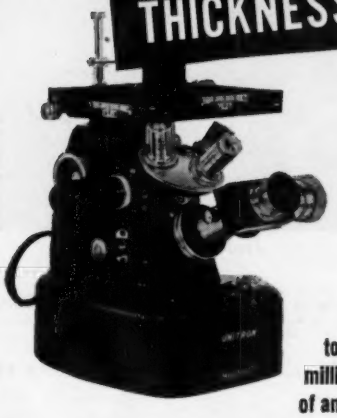
STEVENS

INCORPORATED

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WHY GUESS ?

MEASURE PLATING THICKNESS

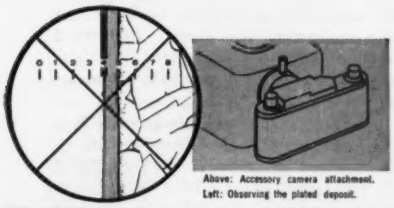


to a millionth of an inch

Your profits depend on meeting tight specifications, maintaining quality control and reducing rejects. Can you afford to guess at plating thickness when it is so easy to *measure and be sure*?

UNITRON'S PL-MEC PLATER'S MICROSCOPE **substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metallurgical microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.**

UNITRON'S PLATER'S MICROSCOPE **will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done—by requesting a FREE 10 DAY TRIAL in your own plant. There is no cost and no obligation.**



Above: Accessory camera attachment.
Left: Observing the plated deposit.

$468 Model PL-MEC complete with all optics and standard accessories	As above with built-in camera attachment, but without 35mm. camera back: $540

THE TREND IS TO UNITRON

UNITRON

INSTRUMENT COMPANY • MICROSCOPE SALES DIV.
66 NEEDHAM ST., NEWTON HIGHLANDS 61, MASS.

Please rush UNITRON's Microscope Catalog 13-H

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Company .....

Address .....

City ..... State .....



George P. Loomis, Jr.

Mr. Loomis graduated from Massachusetts Institute of Technology in 1949 with a Bachelor of Science Degree and received his Masters Degree in Business Administration from Harvard Graduate School. His new duties will include customer service, technical sales activities and new product research and development. Before joining the firm in March, 1957, Mr. Loomis was branch sales manager for Reliance Electric & Eng. Co. He is a member of the National Association of Corrosion Engineers, American Water Works Association and State of Ohio "Engineer in Training."

Davoli Joins Hampden

Charles "Chuck" Davoli has been appointed technical director of the *Hampden Chem. & Equip. Co.* of Philadelphia. He was formerly with the Reynolds Co. as the head of their plating service lab for the past five years. Prior to this, Mr. Davoli was employed with Promat Div., Poor and Co., as the eastern technical service manager. He also worked as general foreman with a local plating and polishing job shop.

Mr. Davoli has attended Miami University of Ohio and Pennsylvania State University. He served in World War II and in Korea in the U. S. Navy and presently holds the rank of Lt. Commander and is active in Naval Reserve of Philadelphia.

General Electric Appoints Glaser

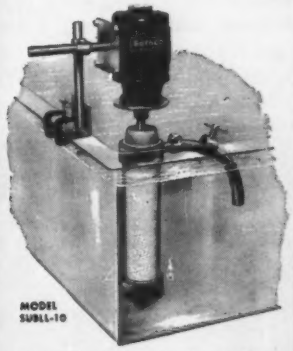
G. Stephen Glaser has been appointed sales representative of the Eastern District of the Silicone Products De-

Sethco

submerged
UNIVERSAL
FILTER SYSTEM

faster, full-view filtration for all corrosive solutions

- **compact, leakproof, non-aerating, continuous duty**
- **easy, trouble-free operation**
- **cartridge has heavier load capacity, replacement made in seconds**
- **fits anywhere on tank — saves floor space, no "jockeying" with hose lines**
- **high speed ⅓ hp motor for faster flow**
- **completely corrosion resistant**
- **quality-built throughout yet costs ⅓ less than heavier, cumbersome types**



Sethco — famous for many firsts in filtration systems — now offers a completely new concept in a submersible type unit. Designed for filtering plating and chemical solutions without "product" loss, the new SUB series represents the ultimate in reliability and economy. Only Sethco provides a choice of construction for universal applications: for acids and alkalies — lucite and epoxy with SS #316 fittings; for temperatures above 140°F. — epoxy and full-view pyrex shell replaces lucite; for high chlorides — epoxy or titanium replaces SS #316.

Write or call for Spec Sheet No. 551

Sethco
MANUFACTURING CORP

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MAyfair 3-4220

DEPTH FILTRATION FOR ALL ELECTROPLATING AND INDUSTRIAL APPLICATIONS • METAL FINISHING • PHOTO PROCESSING • PETROLEUM • SOLVENTS • LACQUERS • PHARMACEUTICALS • ULTRASONIC CLEANERS • RADIOACTIVE SOLUTIONS • WATER • ELECTROTYPING



G. Stephen Glaser

partment of the *General Electric Co.* His office location will be 254 Elizabeth Ave., Newark, N. J.

A graduate of Princeton and Northwestern Universities, Mr. Glaser holds degrees of Bachelor of Science in Mechanical Engineering and a Master's of Business Administration. Following his graduation from Princeton in 1955, he joined E. I. Du Pont de Nemours and Co., Inc. where he served as a project engineer until 1957. He became associated with G. E. in 1958 on the company's marketing training program. His first assignment was at the Semiconductor Department in Syracuse. He served subsequently at plants in Cincinnati, Phoenix, Detroit and Louisville, and he joined the marketing section of the Silicone Products Department in January of this year.

Diversey Names Two Sales Representatives

L. J. Stockwell, St. Clair Shores, Mich., and *C. W. Cockrum*, Hickman Hills, Mo. have been named sales representatives for the Metal Industries Division of *The Diversey Corp.* Mr. Stockwell will serve the Detroit area and Mr. Cockrum will make his headquarters in Kansas City.

Hubbard-Hall Announces Executive Changes

Election of *Frederic R. Kellogg* to chairman of the board, *Edward R. Jones* to president and chief executive officer, and *Richard F. Puffer* to vice-president and director of the Industrial Division has recently been announced by *The Hubbard-Hall Chem. Co.* of Waterbury, Conn.



Frederic R. Kellogg

Mr. Kellogg has been president of the firm for many years and is well known throughout the chemical industry. Mr. Jones, formerly executive vice-president, is also treasurer of the company. Mr. Puffer was formerly assistant general sales manager of the American Brass Co. of Waterbury. He

UP TO 48% GREATER EFFICIENCY!

IMPERIAL PLATING BARRELS

WITH NEW "FIN" DESIGN



An important "first" from Imperial! In actual tests against standard plastisol-coated steel plating barrels, an Imperial all-plastic barrel with the exclusive "fin" design *increased plating thickness 48%*. The secret is reduced electrical resistance and more thorough agitation and uniform circulation in the plating solution.

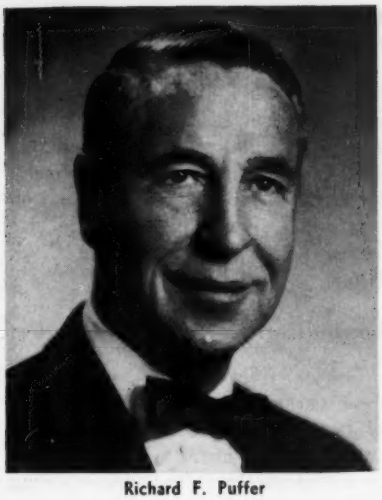
Imperial manufactures higher-efficiency plating barrels in a wide range of sizes, materials, and models. They are 100% interchangeable with the standard barrels on your automatic plating machines. Barrels illustrated are made of polypropylene (*first* used for barrels by Imperial several years ago) or COPOLEFIN—a special olefin copolymer. Features: Sturdy, all-welded and reinforced construction; great resistance to chemicals, stress, impact, abrasion, heat; long service life; light weight; and low cost. They stand up under all solutions and temperatures. The units are also available in high-temperature Plexiglas and other materials, on special order.

Imperial makes horizontal belt and gear driven barrels to fit your existing plating equipment, as well as plastic tanks, ducts, hoods, and other custom-fabricated parts.

All barrels are backed by years of manufacturing experience — plus a warranty. Write now for free literature.

IMPERIAL INDUSTRIES, INC.

4436 Walker Avenue • Wayne, Michigan



Richard F. Puffer

will coordinate industrial chemical and metal finishing product sales and product development.

Astroloy, Inc., to Represent Titanium Products Corp.

Titanium Products Corp. announces the appointment of *Astroloy, Inc.*, 1405 Marcelina Ave., Torrance, Cal., as representatives for all products, serving the 11 western states district. They are qualified to advise on all titanium mill products and anodizing and plating specialties.

Selectrons, Ltd. Formed to Produce, Market Selective Plating Equipment

Selectrons, Ltd., 520 Fifth Ave., New York 36, N. Y., has been organized to build and market selective plating equipment. The company is introducing a new line of power packs, styluses, and electrolytes, designed for controlled deposits of many metals — even alloys — on almost any conductive basis material. A complete national sales and service organization for this process is presently being established.

Nelson Promoted to Sales Manager of Williamsville Buff

John H. Nelson, formerly a sales representative for Southern New England, has been appointed sales manager of the *Williamsville Buff Co.* He is a graduate of Bryant College in Providence, Rhode Island, which he attended following his discharge from the U. S. Navy.



John H. Nelson

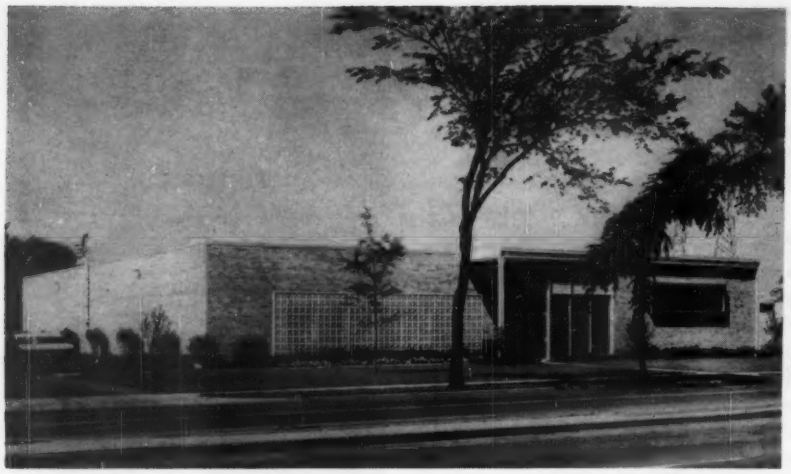
Mr. Nelson has been associated with the company for over 14 years. During this period, he had broad experience in manufacturing, inside sales, and as a field representative in New England.

Beckman Opens New Midwestern Office

Midwestern sales and service head-







quarters for the Scientific and Process Instruments Division, *Beckman Instruments, Inc.*, have been transferred to expanded facilities at 7360 N. Lincoln Ave., Lincolnwood 46, Ill. The division's regional office was formerly located at 4914 W. Belmont Ave., Chicago. The new 10,500 square-foot building will house sales and service offices, a fully equipped repair shop, and an applications laboratory.

Glidden Promotes Schmalfeld

Appointment of *Richard H. Schmalfeld* as industrial sales manager for *The Glidden Company's* Midwest Region has been announced recently. In his new capacity, Mr. Schmalfeld will assume the responsibilities of all operations formerly assigned to *Carroll O. Hutchinson*, who recently has been appointed market development manager at the firm's Paint Division headquarters in Cleveland.

Mr. Schmalfeld joined the company in 1948 as a sales correspondent. A year later he became an industrial sales representative and has acted in that capacity until his appointment. He attended Morgan Park Junior College and DePaul University. He also served for three years in the U. S. Army.

Cowles Purchases Promat Division

Cowles Chemical Co., Cleveland, have purchased the Promat Division of *Poor & Co.* Promat manufactures and distributes metal finishing specialty chemicals including electroplating additives, brighteners, and metal coloring processes. Among the products Cowles manufactures are metal cleaners, zinc phosphate coatings and other metal treating chemicals.

For the time being, Cowles will continue to manufacture Promat products at Poor's plant in Waukegan, Ill., and the sales and servicing of these products will continue to be handled by the Promat organization.

Better Buffing and Polishing?
ANSWER: ALWAYS USE
FORMAX
COMPOUNDS



Formax manufactures a complete line of Buffing and Polishing Compounds in bar, tube and liquid form suitable for all classes of metal, plastic and lacquer finishes. Formax compounds used together with the famous Formax ZIPPO long wearing buffing wheels make a combination that's hard to beat. Our extensive manufacturing, laboratory and testing facilities are always at your disposal.

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BRASS



USE TRUE BRITE
BRASS SOLUTIONS

Trouble Free — Low Cost
Little Supervision Needed
Ready To Use — Just Add Water
Uniform Color — Can Match Colors

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TRUE BRITE CHEMICAL PRODUCTS CO.
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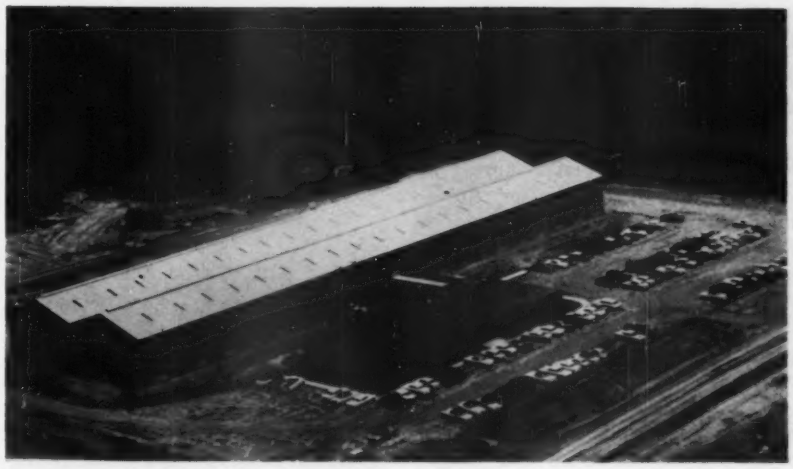
Seymour Mfg. Co. Promotes Brown

The Seymour Mfg. Co., Seymour, Conn., has announced the promotion of *William G. Brown* to vice-president and sales manager of the company.

In 1945 Mr. Brown joined the company as metallurgist and trouble-shooter, after serving with the Western Brass Co. and American Brass in Canada for a number of years. Three years later, he became works manager of the Phosphor Bronze Corp., and in 1951 was appointed a research engineer for the Olin Mathieson Corp., engaging in research in metals.

Mr. Brown returned to Seymour in 1956, becoming successively production manager, plant superintendent, and works manager. He held the last position until his current appointment.

Mr. Brown, a native of New Haven, attended the New Haven public schools and the Lowell Technological Institute.



Sparkler Formally Opens New Plant

Sparkler Mfg. Co., producers of industrial, commercial and municipal filtration equipment, formally opened their newly constructed sales headquarters and plant in Conroe, Texas recently. Operation was moved from two plants in Mundelein and North Chicago, Ill. last March 31.

Despite the unavoidable lag in setting up production in their new plant, manufacturing capacity now already exceeds that of the combined output of the two Illinois plants.

Ionic Appoints Canadian Distributor

The appointment of *Paasche Airbrush (Canada) Ltd.*, as Canadian distributor for *Ionic Electrostatic Corp.*, was announced recently. Paasche Airbrush maintains offices at



ELECTRO-POLISHING

Fast, low cost finish for aluminum, copper and alloys, steel and stainless steel. Ideal for decorative finishes, burr removal, electroplate adhesion and size control. Standard and custom concentrates nationally available in any quantity.

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Let us convince you—send samples for processing.

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OUR BUSINESS

Is MAKING GOOD LACQUER! Our customers buy AGATEEN Lacquers though they know cheaper lacquers are available elsewhere.

AGATEEN, Famous for lasting appearance, adhesion, durability and mileage.

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THE LAST WORD IN QUALITY

864 Pape Ave., Toronto, and 852 Notre Dame Street West, Montreal.

Roto-Finish Co. Licensee for Harperizer

Roto-Finish Co., Kalamazoo, Mich., has been appointed manufacturing licensee of the new "Harperizer" finishing machine, designed to produce a finish equal or superior to buffing on parts with intricate detail, ornamentation, or complex shape, by utilizing a high centrifugal force which holds parts and media together in a tight mass.

A machine is now being installed in their finishing laboratory in Kalamazoo for demonstration and sample processing.

Davies New Rept. for Despatch Oven

H. R. Davies Sales and Engineering Co., New Orleans, has been appointed industrial representative for *Despatch Oven Co.*, Minneapolis. The firm will service the lower Mississippi and Louisiana area.

H. R. Davies, Sr., company founder, has been in engineering and sales for more than forty years in the deep south. He began his career as a New Orleans newspaperman, and in the middle twenties turned to his present field.



H. R. Davies, Sr.

In 1937 Davies organized the firm bearing his name, resigning his position as vice-president in charge of sales with Ross-Meehan Foundries, Chattanooga, Tenn.

Working with Davies will be his son, *S. G. Davies*, a 1948 graduate of the Citadel, Charleston, S. C., with a degree of B.S. in civil engineering.

The younger Davies has been in the engineering and sales field since graduation from college. He is a registered licensed engineer in Louisiana, with rights to practice in Texas and Mississippi, and a member of the Louisiana



S. G. Davies

MULTIPLE BARREL UNITS



FREE TEST SERVICE
Send sample parts and specifications for laboratory processing . . . or ask about Tumb-L-Matic "programmed" finishing processes.

TUMB-L-MATIC TYPE S UNIT

Tumb-L-Matic Type S units employ the dry process, are designed to meet high production volume requirements . . . conserve floor space and provide for greatest possible finishing versatility through individual barrel control.

Tumbling Supplies
Tumb-L-Matic offers a complete line of abrasives, compounds and finishing media . . . from stock. Write for price list.

For more detailed information on Type S units or other Tumb-L-Matic equipment, supplies or processes, write:

TUMB-L-MATIC, INC.
40 St. Mary's Street, Stamford, Conn.

SIMPLE!



UNI-BOLT
Electrode
Rod Insulator

One-piece steel, heavily coated with plastisol . . . no spacer needed. Easy to install. Universal application. Standard sizes stocked. For details, call or write

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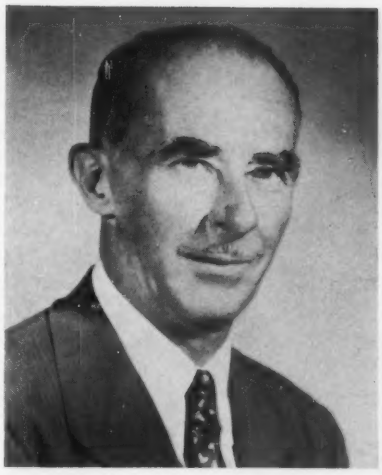
Engineering Society, American Society for Metals, and the Engineers Club of New Orleans.

Blackwell and Beacham Join Ionic Electrostatic Corp.

Ronald Blackwell, appointed to customer research assistance, was formerly paint superintendent of Sunbeam Lighting Co. of Gary, Ind., where his activities entailed formulation of paint, supervision of production, and overall maintenance of conveyorized finishing equipment.



Ronald Blackwell



Dr. William Beacham

Mr. Blackwell, who is stationed at the firm's research laboratory, will be actively engaged in customer research projects and will demonstrate and recommend the firm's electrostatic spray coating equipment.

Dr. William Beacham is well known in the finishing field, for his technical magazine articles and his work with manufacturers in a consulting capacity. His experience in finishing methods includes designing spray equipment, formulating finishes, and considerable research in ultrasonics and high frequency baking.

He was for 16 years associated with Binks Mfg. Co., as director of research laboratories, chief chemist and director of training.

Dr. Beacham received his masters degree in chemistry at Ingraham University, London, England and his doctorate at Sage Institute, Paris, France.

Metal & Thermit Adds Nickel Anodes to Line

Appointment of *Metal & Thermit Corp.* as distributor for nickel anode products has been announced by *The International Nickel Co.*

The nickel anodes are being supplied in the rolled carbon, depolarized and cast nickel forms, and are stocked in Chicago, Detroit, and Rahway, N. J.

Oakite Promotes Basch, Baltzell

Oakite Products, Inc., manufacturers

Here's how you can save money by

DEGREES



TRERICE SELF-OPERATING TEMPERATURE REGULATORS cut your liquid processing costs by maintaining the *one best* temperature. Trerice No. 90000 and No. 90400 Self-Operating Temperature Regulators insure automatic, precision control of liquid temperatures between 40° F. and 300° F. No air or electricity required for operation. Available in either direct or reverse acting models; stainless steel or bronze trim. Most ranges and sizes in stock.

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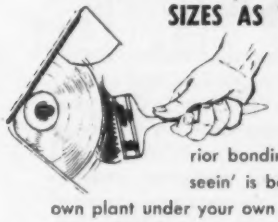
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Gripmaster cuts out one preparation material and one preparation step. No special sizing is necessary. This superior bonding cement has a double use. But seein' is believin'. Test Gripmaster in your own plant under your own working conditions. Send us the enclosed coupon or use your company stationery and we'll send you a test size sample *without charge or obligation.*

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Company .....

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J. Justin Basch



W. A. Baltzell

of specialized chemical compounds, have announced the election of *J. Justin Basch* as second vice-president, and *William A. Baltzell* as vice-president.

Mr. Basch joined the firm in 1925 as representative in Pittsburgh. He became Philadelphia division manager in 1930, and has been vice-president in charge of marketing since 1958. He will continue to be responsible for the firm's marketing and research and product development programs.

Mr. Baltzell has been with the company since 1941, first as sales representative in Dallas, then as manager of the southern division. In 1958 he was appointed industrial sales manager, which position he will continue to hold.

U. S. Stoneware Adds to Staff of Chamberlain Laboratories

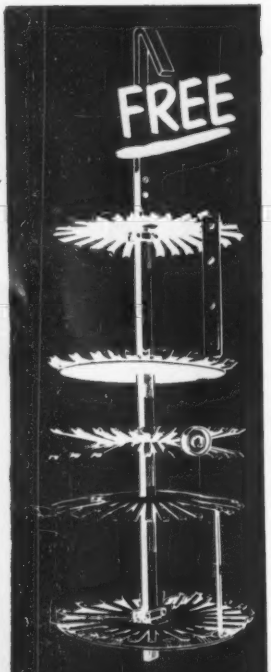
Two new additions to the staff of Chamberlain Laboratories, the research and development center of *The U. S. Stoneware Co.*, have been announced by the Akron, Ohio firm.

Richard H. Freyer has been named manager of the testing laboratories. A chemical engineering graduate of Tri State College of Engineering, Freyer was previously employed by Pratt & Whitney Aircraft Division of United Aircraft Corp. as a project and testing engineer.

Alan Corry has joined the staff as research engineer. Formerly a research and development project engineer with the Electric Boat Division of General Dynamics Corp., Corry holds a master of science degree in chemical engineering from the University of Rhode Island.

Metal & Thermit Corp. Expands Facilities

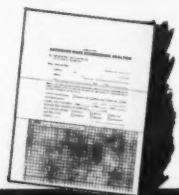
Metal & Thermit Corp. has expanded its activities in the minerals field with the acquisition of the resources



ENGINEERING ANALYSIS of your ANODIZING RACK *Problems!*

Write for your Free ANODIZING RACK ENGINEERING ANALYSIS form. Cut your Anodizing Costs by determining which type of rack is best for your particular requirements. We carry many types of all-Titanium racks in stock—adjustable, high-capacity, etc.—fast, economical custom service a specialty.

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Dept. MF, 131 N. Green St., Chicago • Or Call CH 3-7383

Anodizing Rack Specialists since 1947

IT'S NEW!

VYCOTE VINYL AEROSOL



FOR USE IN

ELECTROPLATING • ANODIZING • MASKING
RACK COATING • DUCTS & VENTS • HOOKS
REPLACEMENT TIPS

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RESISTS — ACIDS • FUMES • ALKALI • SALT SPRAY

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GOOD ADHESION • ELECTRICAL INSULATOR

VYcote is a convenient aerosol spray can for quick touch up . . . it dries in minutes to a tough durable plastic coating. Has many uses in one fast easy application.

VYCOTE is made of a high quality vinyl which coats evenly and prevents corrosion under severe exposure conditions.

VYCOTE improves appearance and protects against action by water, alkalies, acids, salt spray and adheres to clean metal and other coated or uncoated surfaces.

VYCOTE in addition to sealing out moisture may be used as an electrical insulator and has good dielectric properties.

VYCOTE COMPANY

P. O. Box 6893
JOURNAL SQUARE STATION
Jersey City, N. J.

AVAILABLE in GRAY & BLACK
$2.75
PREPAID
ONE POUND SPRAY CAN

and facilities of *Orefraction Minerals, Inc.* The purchase involved approximately $1,000,000 in cash.

The 44-year-old Orefraction Minerals, Inc., with facilities in Andrews, South Carolina, supplies granular and dry milled zircon for the foundry, refractory, ceramic and glass industries.

Sel-Rex Announces Appointment and Promotion

Thomas Kohler, formerly applications and sales engineer with Allied Research Products for the past seven years, has been named New York State resident sales engineer for *Sel-Rex Corp.,* Nutley, N. J., manufacturers of precious metal plating processes. In his new assignment, Mr. Kohler will report to *René Sonnenfeldt,* the firm's representative in the area for several years, who has been promoted to district manager.

Mr. Kohler, who holds a degree in chemistry from St. Lawrence University, has held technical, engineering and sales positions in industry for over 15 years. His background includes positions with U. S. Gypsum, production chemist; Sheffield Farms, production supervisor, organic chemicals; Cherry-Burrell, metallurgical chemist; and Wall Wire Products Co., where he was plating supervisor for over five years.



Thomas Kohler



Rene Sonnenfeldt

A resident of Fayetteville, N. Y., Mr. Kohler will cover Western and Northern Pennsylvania, as well as Western New York State, for the company.

A chemical engineering major at the university in his native Utrecht, Holland, Mr. Sonnenfeldt gained considerable "trouble shooting" experience with Dutch companies as a service and sales engineer, which gave him first hand knowledge of electroplating and metal finishing as practiced in Europe. In addition to enabling him to provide an unusual service to customers, this experience has formed the basis for an interesting informal talk

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120,000 SQUARE FEET

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WITH THE COUNTRY'S GREATEST VALUES IN PLATING, POLISHING and SPRAY PAINTING EQUIPMENT.

- Agitators
- Air Compressors
- Anodizing Equipment
- Barrel Finishing Equipment
- Belt Polishing Machines
- Blowers
- Centrifugal Dryers
- Circulating Pumps
- Degreasers
- Ducts
- Dust Collecting Systems
- Electropolishing Equipment
- Filters
- Furnaces and Ovens
- Generators
- Heaters
- Paint Spray Equipment and Accessories
- Plating Units, Semi and Full Automatics
- Rheostats and Controls
- Rectifiers: Selenium, Germanium, Silicon-Type
- Sand Blasting Equipment
- Tanks: Metal, Lead, Rubber and Plastic Lined, Wood ... AND MORE!

BOTH NEW and REBUILT ... including such well known names as ALSOP, INDUSTRIAL FILTER, BLAKESLEE, CHANDEYSSON, GLO-ROD, HULL, KOCOUR, KREIDER, HVWM, LASALCO, PACKER, BELKE, UDYLITE and many others.

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AIR MAKE-UP UNITS BY KOCH

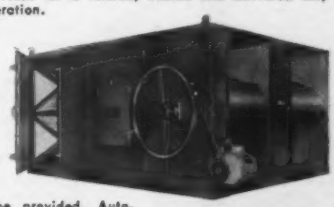


GRAVITY SYSTEMS

Koch Gravity Air Make-Up Systems are economical and efficient . . . save fuel and power . . . use throw-away filters. Available with gas or steam heating units. Have weather louvers outside — diffusion surface inside.

Installed in a factory window to replace air exhausted from process equipment. The vacuum created in the factory by this exhaustion is relieved by air drawn through the gravity unit. Fresh air is filtered, heated and delivered only when process equipment is in operation.

Koch Forced Air Replacement Systems are quiet and automatic. Carefully engineered control systems assure accurate and consistant air volume and temperature. Available with gas or steam heating coils.



Furnished in four basic sizes delivering from 6,000 to 28,000 c.f.m. Either diffusers at the blower or ducts for plant wide distribution of air can be provided. Automatic controls assure accurate and consistant air delivery and temperature.

BLOWER SYSTEMS

Call Koch for free engineering analysis of your heating, cooling, ventilating or exhausting problems . . . over 50 years experience serving American industry.

GEORGE KOCH SONS, INC., EVANSVILLE 4, INDIANA

he has given before several chapters of the A.E.S.

Prior to joining Sel-Rex in 1955, Mr. Sonnenfeldt held technical positions with American Plating Inc., Zelienople, Pa., and Bart Laboratories, in Belleville, N. J.

New Distributors Announced by Dresser Electric

Dresser Electric Co., Detroit 7, Michigan, has appointed several new distributors to handle its complete line of plating rectifiers. *Du-Tone Chemical Co.*, Waukegan, Ill. will cover Illinois and Wisconsin; *Keystone Plating Supply Co.*, Detroit, Michigan in Michigan, northern Indiana and Ohio; and *Bill Young & Company, Inc.*, Cincinnati, Ohio in southern Ohio and Indiana, Kentucky and Tennessee.

Manufacturers' Literature

Electric Heaters

General Electric Co., Dept. MF, Schenectady 5, N. Y.

Bulletin GEC-1005K, a completely revised 48-page catalog, lists product and application data for Calrod tubular, finned tubular, cartridge, strip, insertion, and vane heaters; forced and natural convection air heaters; and Form G and edgewound oven heaters. In addition, there are sections on heater control and wiring diagrams.

Application and heater selection are included in both long and short forms. Photos and dimensional drawings are shown for almost all types of heaters. Stock items are listed in bold-face type and there are cross references between product pages and control and accessories.

Flat Polishers

Acme Mfg. Co., Dept. MF, 1400 E. Nine Mile Road, Detroit 20, Mich.

A new 4-page, two color, illustrated catalog describes a complete line of flat surface grinding and polishing machines for finishing and deburring parts such as: sheets, bars, strips, coils, blanks, printed circuit boards, stampings, forgings, die castings, and sand castings.

Surface Treatment for Aluminum

Hughson Chemical Co., Div. Lord Mfg. Co., Dept. MF, Greengarden at 12th, Erie, Pa.

Chemlok 720, an organic chemical surface treatment for aluminum, is featured in Technical Bulletin 7003B. Its properties are listed, procedure given for use, and tables show relative adhesion between aluminum and organic materials.

Aluminum Cleaner

Hughson Chemical Co., Div. Lord Mfg. Co., Dept. MF, Greengarden at 12th, Erie, Pa.

Chemlok 701, an alkaline cleaner, is described in Technical Bulletin 7001B. Six steps are given in the recommended procedure for its preparation and use, as well as physical and chemical properites, plus basic equipment needs and control.

Viscometers

Norcross Corp., Dept. MF, 247 Newtonville Ave., Newton 58, Mass.

Bulletin No. V-1230 gives the features of the above firm's viscometers for atmospheric pressure applications; also the principle of operation and a list of processes for which they provide industrial control.

Electric Ovens

Trent, Inc., Dept. MF, 211 Leverington Ave., Philadelphia 27, Pa.

A twelve-page catalog, Bulletin 71-TH-1960, describes a complete line of industrial high temperature, recirculating, gravity and forced convection ovens.

In addition to the standard basic ovens, the catalog covers a variety of special designs for such electrical heating applications. It also includes a discussion of the advantages of folded-and-formed ribbon-type resistance heating elements, which allow extremely accurate process control over a wide temperature range, yet seldom, if ever, need replacement under normal operating conditions.

Plating Barrels

Hanson-Van Winkle-Munning Co., Dept. MF, Church Street, Matawan, N. J.

Nine new plating barrel and accessory equipment bulletins describe and picture Mercil-type portable barrels, special barrel equipment, Mercil-type hanger equipment, hanger mounted motor drive equipment, cylinder materials and construction, plating barrel contacts, tank and drive equipment, and tank transfer equipment. A final bulletin gives complete specifications for all standard model barrel units and all Mercil-type model MH barrel units.

All bulletins are contained in a color folder, No. PB-111.

Selector Guide for Work Gloves

Glove Div., Riegel Textile Corp., Dept. MF, Conover, N. C.

A new selector manual covers basic types and styles of work gloves, with scores of sketches. The guide is complete with information on basic cuts, cuff styles and other specification detail. It contains tips on many points

DEPENDABLE PPI PRODUCTS

RUBBER-AND PLASTIC DRUM LINERS
MONEL, STEEL COPPER AND TITANIUM ANODE HOOKS
PLASTIC COATED PAILS AND DIPPERS
POLYETHYLENE TANKS AND PAILS
TITANIUM ANODE SCRAP SAVER BASKETS
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SWIMMING POOL CHEMICALS
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ACID TANKS AND CONTAINERS
HAND CHEMICAL PUMPS

NEW • STURDY • LIFETIME

PPI Titanium Scrap Saver Anode Baskets

Completely Made of Titanium Metal with Rugged Welded Frame . . . Built to Last Almost Indefinitely When Used in Nickel or Acid Copper Plating Solutions

Advantages that will make you money

- Nickel and Copper anode scrap makes perfect electrical contact to titanium basket and draws full current
- Solutions have no effect on titanium metal either with or without current
- Eliminates the hazards of plating failures that occur when using plastisol coated steel baskets
- Eliminates all possibilities of iron contamination

NOTE: Titanium metal can't be used in fluoborate solutions

Titanium Scrap Saver Baskets are made in graduated sizes . . . write today for prices, details, and advise us of your requirements.



PATENT PENDING

PLATING PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA

such as grades of leather, chemical resistance and physical properties of various plastic coatings. A second section contains on-the-job case histories where changes in work glove specifications, increased hand protection and lowered glove costs.

Rubberized Abrasives

Cratex Mfg. Co., Inc., Dept. MF, 1600 Rollins Road, Burlingame, Cal.

An authoritative 22-page manual on the many uses and applications for rubberized abrasives gives actual case histories on a variety of typical applications. In addition, it outlines the most efficient methods for mounting, dressing and trueing. Recommended operating speeds are also listed.

Ultrasonic Cleaning

Powertron Ultrasonics Corp., Dept. MF, Patterson Place, Roosevelt Field, Garden City, New York.

A new bulletin, "How to Clean Ultrasonically with Self Tuning" provides a basic explanation of how ultrasonics works, what it can do to cut time and labor costs, and a guide to the selection of tank and generator sizes for various jobs. A discussion of the Autosonic line of self tuning cleaners, is also included.

A thorough chart-guide to the correct cleaning solutions and temperatures for ultrasonic removal of more than 20 different common contaminants completes the bulletin, designated 60-1.

Solid Film Lubricant

Hohman Plating & Mfg. Co., Dept. MF, 814 Vermont Ave., Dayton, Ohio.

The new Surf-Kote A-1290 air drying solid film lubricant is described in a two-page bulletin.

Surfactants

Rohm & Haas Co., Dept. MF, Washington Sq., Philadelphia 5, Pa.

A new 16-page brochure, entitled "Triton — Alkylphenol Surfactants," has graphic and tabular data on the properties of nonionic surface-active agents, and includes a number of application illustrations. The products discussed in this booklet are known generically as alkylphenoxy polyethoxy ethanol (APPE) compounds and include both octylphenol and nonylphenol nonionic types. Characteristics such as physical properties, solubility, compatibility, viscosity, surface and interfacial tension are tabulated.

Tank Linings

Wisconsin Protective Coating Corp., Dept. MF, Green Bay, Wis.

Plasite #7155, air dried protective coating (cures at room temperature) for use as a lining for tanks is described in Technical Bulletin M-7.

Portable Sand Blaster

ALC Co., Dept. MF, RD #5, Box 40, Medina, Ohio.

A new two-page brochure in color on a rugged and powerful sand blaster outlines complete specifications on the new Model B "Sandy Jet."

Cleaners and Specialties

Macco Products Co., Dept. MF, 9210 S. Sangamon St., Chicago 20, Ill.

This handy pocket-size brochure tells how to select cleaners, cutting lubricants, drawing compounds, rust preventives, forging compounds, and extrusion lubricants, and lists 46 different compounds in the above categories to simplify selection by pinpointing to specific applications.

Plating Coatings

Munray Products, Inc., Dept. MF, 12400 Crossburn Ave., Cleveland 11, Ohio.

A new catalog, No. 959, covers four types of coatings, (1) PC-7 air-dry coatings; (2) PC-11 baked-on plastisol coating; (3) SO-8 stop-off lacquer; (4) V-10 extended life air-dry coating; together with specifications and applications to the plating industry.

Chemicals

Hooker Chemical Corp., Dept. MF, P.O. Box 344, Niagara Falls, N. Y.

Ninety-four organic and inorganic chemicals are concisely reviewed in a newly revised and enlarged, 16-page, quick-reference digest.

The new bulletin, No. 100-D, gives useful factual information covering 88 commercially produced chemicals and six development products. Included are more than 20 new or recently developed chemicals. A thumbnail description, physical data, chemical formula, uses, and types and weights of shipping containers are presented for all 94 chemicals listed.

Semi-Automatic Conveyor

Hanson-Van Winkle-Munning Co., Dept. MF, Church Street, Matawan, N. J.

A new, two-page color bulletin, No. SA-104, illustrates and describes such semi-automatic conveyor features as variable speed drives, horizontal agitation, typical current carriers and drive mechanisms.

Two schematic diagrams and a table of specifications complete the description of the unit.

Automatic Analyzer

Graver Water Conditioning Co., Dept. MF, 216 W. 14th St., New York 11, N. Y.

Four-page, color bulletin, WC-127, on the new Automatic Tape Analyzer, covers all facets of the unit, including

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method and principle of operation, potential applications and basic specifications for the instrument, and the Millipore filter tape used as the testing medium. It also gives design data, including components and materials of construction. Copies of the bulletin are available from Graver without obligation.

Maintenance Painting Guide

Industrial Maintenance Div., Sherwin-Williams Co., Dept. MF, Cleveland 1, Ohio.

This 24-page, full-color book discusses the different uses for various types of primers and finish coats, and shows samples of the colors available. In addition, it describes a number of special-purpose paints, detailing their properties and recommended application methods.

One section of the guide spells out in detail the steps necessary for proper surface preparation. A two-page chart pin-points the recommended finishes for different types of surfaces, indicating the resistance of each finish to chemicals and other destructive agents.

Casting Cleaning Equipment

Wheelabrator Corp., Dept. MF, 1150 S. Byrkit St., Mishawaka, Ind.

An informative brochure on dual-purpose core knock-out and blast cleaning equipment for the foundry industry, contains diagrams and drawings, photographs of castings before and after core knock-out and cleaning, and case history information. Step-by-step description of the core knock-out cycle and the blast cleaning cycle is given in the literature.

Electrostatic Hand Spray Gun

Ionic Electrostatic Corp., Dept. MF, 111 Monroe St., Garfield, N. J.

An illustrated bulletin, I-60, describes the firm's recently developed electrostatic hand spray gun with the new electrocentrifugal dispersion technique.

Metal Parts Servicing

Jones Sealing Service, Inc., Dept. MF, 6 S. Occidental, Tecumseh, Mich.

A four page, illustrated brochure outlines some of the processes done by the above firm, such as impregnation, phosphating, ebonizing, metal bonding, and barrel finishing. A description is given of each process, also its advantages.

Organic Finishes

Randolph Products Co., Dept. MF, Carlstadt, N. J.

A new 4-page folder describes the finishes for plastics formulated by the above manufacturer. The brochure describes the coatings available for the range of plastics from acetates to vinyl, and also supplies important pointers in application procedures.

Preparing Copper for Plating

Becco Chem. Div., Food Machinery & Chem. Corp., Dept. MF, Station B, Buffalo 7, N. Y.

The use of a short dip in ammonium persulfate solution instead of the usual acid dip, prior to plating on copper and its alloys, is described in Bulletin 109.

The advantages of the process, such as lower porosity and minimum attack of the basis metal are detailed.

Finishing Silver Plate

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

A new technical data sheet on decorative finishing of silver plated articles covers types of finishes, such as hammered, satin, bright and dull butler, oxidized, semi-mirror, mirror and ultra-mirror. Data include abrasive compound grades, buffing wheel speeds and operating instructions.

Cleaning Steel for Galvanizing

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

Bulletin No. 80A points out that proper preparation of steel is essential before its immersion in the zinc bath, and the higher the standard of cleaning, the better the quality of the coating. It offers a choice of methods for soil removal and pickling, and shows how solvent precleaning improves efficiency and gives greater economy.

Finishing Products and Processes

Hanson-Van Winkle-Munning Co., Dept. MF, Church Street, Matawan, N. J.

A new bulletin, No. PP-103, lists and describes all the above manufacturer's products and processes.

An illustrated description of the

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Heavy gauge steel with wire woven through steel angle firmly attached to main stem. Cannot come apart or loosen. Side clip is for STUTZ BARREL PLATING TANKS having submerged rectangular anode bars. Side clip not furnished for racked plating tanks. Standard hook 6 inches. Other hook lengths available, however deliveries could be delayed.

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laboratory, and testing and field services available to customers are included.

NEWS FROM CALIFORNIA



Product Techniques, Inc., 511 East 87th Place, Los Angeles, is one of the fastest growing of the newer plating enterprises in the Southern California area.

Organized in November, 1958, by *Frank Morgan* (president) and *Gordon Throne* (vice-president and general manager), the company recently increased its production range by installing equipment for cobalt-nickel plating. The new equipment is being used for work on memory drums for computers and electronics industry plating in general.

The company's plant is also equipped to do job shop work and, for that purpose, has three nickel tanks — bright nickel, hard nickel and electroless nickel. Facilities for electroless gold plating are also available.

Anadite, Inc., a chemical milling and metal finishing firm with headquarters in South Gate, Calif., has major programs underway at its Southern California plant and at its southwestern facilities in Hurst, Tex., to provide for increased production of color anodizing of architectural trim parts.

The company recently established an Architectural Division which concentrates on matters concerned with color anodizing. In August the firm was awarded two large color anodizing contracts. One was for the exterior aluminum panels for a new Los Angeles International Airport building, the other for exterior trim for the chapel at the Air Force Academy in Colorado Springs, Colo.

Installation was recently completed on a new high-speed continuous annealing line at the United States Steel Corp.'s sheet and tin mill in Pittsburg, Calif., where tin plate for the western canning industry is produced.

The new line is designed to operate at a maximum speed of 1,500 feet per minute and to process steel strip of 0.007 to 0.015 inches thick and up to 38 inches wide, in coils weighing 42,000 pounds.

The initial pre-rolling operation at the Pittsburg plant involves processing the steel strip through one of two continuous pickling lines for acid removal of oxide scale. The plant is equipped with two tandem cleaning tanks for soak alkaline cleaning, electrolytic cleaning facilities, and three electrolytic tinning lines for the steel strip.

Walter Sheets, president, and *Walter Mitchell*, executive vice-president, were among Detroit home-office officials present at the recent dedication of the R. C. Mahon Company's new plant in Torrance, Calif.

The new plant was erected and equipped at a cost of $3½ million, and is equipped to produce building products as well as metal finishing systems,

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paint booths, and special processing machinery. Containing 200,000 square feet of floor area for manufacturing, the building is situated on a 30 acre tract in Torrance, 15 miles southwest of downtown Los Angeles.

Among new equipment installed in the plant of Metallurgical Consultants, 4935 East Slauson Ave., Maywood, Calif., is a sodium hydride descaler. The unit was designed and built by company technicians for treating fasteners, braze assemblies and other very small parts.

Technical Metal Finishing Co., 4435 San Fernando Road, Glendale, Calif., has announced it has been licensed to handle the aluminum hard coating process developed by Sanford Process, Inc., of Los Angeles. Technical provides metal finishing services for the aircraft, electronics, and general industry.

An attendance of approximately 35,000 electronics industry executives and engineers was recorded at the 1960 Western Electronic Show and Conference held August 23 to 26 in the Los Angeles Sports Arena.

The four-day technical conference was featured by the presentation of 200 papers at 44 sessions. The technical programs were designed to be effective on three levels: theoretical advanced sessions, systems and engineering concepts, and applications of electronic equipment to current problems. The latest in space age electronic equipment was exhibited in nearly 1,000 booths by 975 firms.

Dr. Arnold O. Beckman, president, Beckman Instruments Co., Fullerton, Calif., has been announced as one of three recipients of the University of Illinois' 1960 Achievement Award for leadership in the field of precision instruments. Dr. Beckman, then a chemistry teacher at the California Institute of Technology, Pasadena, established his company in a garage in 1930. Today it operates plants in the United States, Canada, Switzerland, Scotland, and Germany.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

San Francisco Branch

The August meeting of the San Francisco Branch was called to order at 8:30 P.M., August 11, by *Guy Condrott*, who introduced the following guests: *Dick Andrews*, *Bob Lasko*, and *King Waldorf*.

Calvin E. Snelgrove, secretary-treasurer, introduced the speaker, *George L. Kresa*, sales representative for Kalman Floor Co., who spoke on "Epoxy Floor Topping in the Metal Finishing Industry." Following the talk, there was a long question and answer session regarding details for preserving plating [illegible]om flooring.

Mr. [illegible]tt opened the business meeting and [illegible]lled for the national convention de[illegible]es' report on the national Americ[illegible]lectroplaters' Society business meeting in Los Angeles. He also discussed the recent regional branch meeting he attended, pointing out the preparations being made to have speakers tour the West Coast from San Diego to Seattle-Vancouver area on an organized speakers' program.

Plans for the First San Francisco Educational Session on Saturday, February 18, 1961, moved a step further forward as committee chairmen were formed as follows:

Hotel-Food Committee — *J. R. Pattenger.*

Entertainment Committee — *Fred Huntington.*

Speaker Committee — *C. E. Snelgrove.*

Registration Committee — *Elston Flores.*

Ticket Committee — *Trevor Harry.*

Publicity Committee — *John Natwick.*

Ladies Committee — Not yet verified.

A motion was made, seconded, and carried to contact *Bill Ferry* regarding his plating course for the coming year, and a motion to adjourn was carried at 10:30 P.M.

C. E. Snelgrove,
Secretary-Treasurer

Southeastern Branch

Ladies were honored at the Druid Hills Country Club in Atlanta on August, 20, at the 10th Annual Ladies Night. Platers and their wives came in from greater Atlanta, Jonesboro, Adel, Anniston, Carrollton, Athens, Ga., Nashville, Greeneville, Tenn., and Greenville S. C. Many new first nighters were recognized this year as the attendance reached 53. The invocation was offered by *Justis Belville* of Jonesboro.

Vice-President *Vince Cashen* pre-

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sided and delivered a short welcome speech. *Clem Hohner* was recognized as chairman of the Ladies Night Committee. *H. R. Stogner, Sr.* reported on the Los Angeles Convention, explaining the various voting manipulations whereby the Dixie Regional request for the 1966 National Convention was changed from the previously agreed location in Atlanta to location in Miami. He went on to say that the convention in Miami will be a regional affair but will be hosted by the Southeastern Branch. Stogner closed his report by suggesting informally that Mr. Hohner be selected for convention general chairman (formal action awaits regular meeting action).

Eleven door prizes including a grand prize were donated by ten plating shops. Dancing followed to the musical rhythm of Wes Baxter and his band.

Everyone regreted the unfortunate absence of the branch president, *Myron M. Randman*, who was seriously ill in a local hospital. Mr. Cashen announced that flowers had been sent by the branch.

Appreciation for the splendid arrangements which led to our largest attended and most enjoyable ladies festival are due to Mr. Hohner and his committee: *H. R. Stogner Sr., Jerry LaChappell,* and *Harry Pink.*

Robert H. Probert,
Assistant Secretary

Five Western Branches Form Educational Council

The 47th Annual A.E.S. Convention held in Los Angeles, July 24-28, saw a gathering of the officers of the five far western branches. San Diego, which is now organizing for admittance into the society, was also present. This contingent was brought together to recognize the possibility of establishing a far west regional branch. It was decided that traveling distances for a regional branch was prohibitive.

The above discussion led into the establishment of a far western educational council. It was proposed that all six far western branches namely: San Diego, Los Angeles, San Francisco, Portland, Seattle, and Vancouver would work together to bring more and better speakers to the West Coast.

It was resolved that all branch meetings would follow one another, to allow a speaker to be present at all six branches within a two week period. San Diego will hold their meeting on the second Tuesday of every month, Los Angeles the second Wednesday, and San Francisco the second Thursday. Portland will meet on the third Tuesday, Seattle the third Wednesday, and Vancouver the third Thursday. The librarians of each branch will exchange speaker lists so as to schedule speakers in the order above.

F. M. Guy Condrott,
Acting Secretary
Far Western Educational Council

Midwest Regional Council

The second annual Midwest Regional Conference will be held on Saturday, October 29, 1960 at the University of Notre Dame.

Registration will take place from 9:15 to 10:00 a.m. in the Engineering Bldg. Lobby, where the exhibits will also be on display. From 10:00 to 11:45 a.m. two papers will be presented at the Educational Session in the Engineering Auditorium, "Plating Room Safety" and "Plating Personnel."

The luncheon will be held at the Morris Inn from 12:00 noon to 1:00 p.m., following which three workshop sessions will be held. Workshop A, on mechanical finishing, will be moderated by *Chester Borlet;* workshop B, on plating, by *Manuel Ben;* and workshop C, on organic finishing, by *Duke Wysong.*

Registration fee is $3.00 each, plus $2.75 for the luncheon. Further information may be obtained by contacting *Eugene Roth* at Roth Plating Corp., 739 College, Sound Bend, Ind., CE 3-9351.

OBITUARIES

GEORGE W. GRUPP

George W. Grupp, former free-lance writer and Washington correspondent for METAL FINISHING, died recently at his home in Washington, D. C.

Born in Buffalo, N. Y., he was a Captain in the Red Cross during World War I, later became an instructor in Naval architecture in New York City, then moved to Washington, D. C., where he was a member of the National Press Club. He was also a member of the Washington-Baltimore Branch of the American Electroplaters' Society.

Mr. Grupp, 70, had been an only child and he never married. He is survived by several cousins.

C. F. WENTWORTH

C. F. Wentworth, Long Beach, Calif., Pacific Coast manager of the Metal Industries Division of *The Diversey*



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Corp., died August 8 after a long illness.

Mr. Wentworth joined the firm in 1946 as the company's sole West Coast representative serving the metals industries. At the time of his death he supervised all metal industries operations in California, Washington and Oregon.

He was a member of the Los Angeles Branch of the American Electroplaters' Society and was widely known throughout the metal industries of the Far West.

LETTER TO THE EDITOR

July 27, 1960

Mr. Nathaniel Hall
Technical Editor
Metals & Plastics Publications, Inc.
381 Broadway
Westwood, New Jersey

Dear Mr. Hall:

In the June 1960 issue of METAL FINISHING, in the section entitled "Shop Problems," were some comments concerning "Phosphate vs. Chromate Conversion Coatings on Aluminum." I believe the statements in both the question and answer could confuse a lot of people.

First, at no place in either the inquiry or the answer are the types of phosphate and chromate coatings under discussion qualified. There are two classes of phosphate coatings and two classes of chromate coatings used to prepare aluminum for painting. They are:

Crystalline phosphate
Amorphous phosphate
Alkaline chromate
Acid chromate

Proprietary compounds from all four groups are being used in production at the present to prepare aluminum surfaces for painting. Let us now examine these four types of pretreatments separately to determine their general properties and make-up.

Crystalline phosphate coatings are designed for and used primarily on ferrous surfaces. They will deposit on aluminum under proper operating conditions, but offer only slight improvement over thoroughly cleaned aluminum as a base for organic coatings.

Corrosion resistance is improved slightly. The outstanding feature of the crystalline phosphate system is that parts with mixed metal surfaces may be successfully treated.

Amorphous phosphate coatings were designed specifically for aluminum and provide an excellent base for organic coatings. Corrosion resistance is also materially improved. These coatings impart a green color to aluminum and are being used by themselves as a finish for aluminum building products.

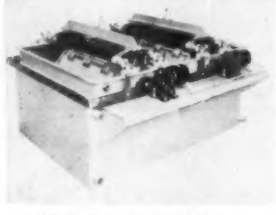
Alkaline chromate coatings, although widely used in Europe to prepare aluminum for painting, have never gained much popularity in this country. They are inexpensive to apply and do provide improved paint adhesion; however, bath control is ticklish and sludging is a problem.

Acid chromate coatings are the most common method of preparing aluminum for painting. There are now dozens of coatings of this type on the market. While they are not markedly superior to the amorphous phosphate type in either painted performance or corrosion resistance they are at least equal. Their real benefit comes from ease and economy of operation.

In the evaluation of several thousand painted aluminum panels, pretreated with either amorphous phosphate or acid chromate type coatings prior to painting, we have found just a hint of superiority for the acid chromate type. This has proven true for both air dry and baked finishes. With either type coating properly applied to aluminum, painting is easy and a long and useful life for the painted product can be expected.

Second, in the answer, both anodizing and wash primers were also mentioned as possible pretreatments. Anodizing does have definite value as a paint pretreatment. However, you cannot say anodizing per se with a 5 minute seal in dilute chromic acid is a good paint base. The anodizing conditions should be specified. For many

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*3.6-5.0 pH	8.6-10.0 pH
*2.4-3.9 pH	10.1-11.3 pH
1.0-2.8 pH	10.5-13.0 pH
0.4-1.4 pH	11.0-13.1 pH

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of our applications an anodizing pretreatment with a poor choice of anodizing conditions would not even approach the chemical conversion coatings in paint holding properties. Specialty anodizing baths designed specifically to prepare aluminum for painting produce excellent results (See Axtell, U. S. Patent 2,721,835, assigned to Shwayder Brothers), and can offer economic advantage over chemical conversion coatings.

As for wash primers, we have found them quite fickle in providing adhesion of organic coatings to aluminum. The most common fault is lack of adhesion between the top coat and the wash primer. Very seldom does the wash primer fail to adhere to the aluminum substrate. This, coupled with an unfortunate tendency of many users to mis-apply wash primers, has caused us to be cautious in recommending them.

Please feel free to pass the above information on to your inquirer, G. S.

Yours very truly,
Harold A. Page,
Research Chemist
Kaiser Aluminum &
Chemical Corp.
Finishing & Electrochemical
Applications Branch

NEW BOOKS

Symposium on Electrodeposition and Metal Finishing

Published by The India Section, The Electrochemical Society, Inc., Indian Institute of Science, Bangalore 12, India. 1960. 190 pages. Price: Rs. 15, foreign.

The symposium, held in Karaikudi in December 1957, included papers on a variety of subjects, some of which are of no interest to the metal finisher. However, 21 of the 36 papers deal with interesting aspects, such as deposition from different types of baths, alloys, conversion coatings, hard anodizing, and electropolishing. Although publication has been delayed, the value of the information has in no way depreciated, and a number of interesting details will be found in the papers, especially on pyrophosphate baths.

The Fundamentals of Electrochemistry and Electrodeposition

By Samuel Glasstone. Published by Franklin Pub. Co., Inc., Palisade, N. J. 1960. 90 pages. Price: $3.20.

First published under the auspices of the American Electroplaters' Society in 1943, this exposition of the basic principles of electrochemistry and electrodeposition has been in great demand and the exhaustion of copies in print has indicated a need for this second edition. Although very few changes have been required, the expansion of the industry will make this small volume a welcome addition to the libraries of finishers who have entered the field too late to obtain copies of the first edition.

The book covers all the important aspects of the subject clearly and simply, so those with no scientific background will readily understand them.

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CALENDAR

Oct. 12-14: 7th National Symposium, American Vacuum Society, Cleveland-Sheraton Hotel, Cleveland, Ohio.

Oct. 17-21: 42nd National Metal Exposition and Congress, A.S.M., Trade and Convention Center, Philadelphia, Pa.

Oct. 27-28: 42nd Meeting, Galvanizers Committee, American Zinc Institute, Onesto Hotel, Canton, Ohio.

Oct. 27-29: 73rd Annual Meeting, National Paint, Varnish and Lacquer Association, Drake Hotel, Chicago, Ill.

Oct. 29: 2nd Annual Midwest Regional Conference, University of Notre Dame, So. Bend, Ind.

Oct. 31-Nov. 2: 38th Annual Meeting, Federation of Societies for Paint Technology, Hotel Sherman, Chicago, Ill.

Nov. 8-11: First National Exposition and Congress, Society of Die Cast Engineers, Detroit Artillery Armory, Detroit, Mich.

Nov. 16-18: 22nd Annual Shop Practice Forum, Porcelain Enamel Institute, University of Illinois, Urbana, Ill.

Jan. 17-18: Annual Meeting and Conference, Society of Vacuum Coaters, Lake Towers Motel, Chicago, Ill.

Feb. 3-4: 3rd Annual Dixie Regional Technical Session, A.E.S., Blue Ridge Host Branch, Hotel Roanoke, Roanoke, Va.

Feb. 4: Annual Educational Session and Banquet, New York Branch A.E.S., Statler-Hilton Hotel, New York, N. Y.

Feb. 4: 7th Annual Tri-State Regional Meeting, A.E.S., Deshler-Hilton Hotel, Columbus, Ohio.

Feb. 11: 8th Interim Meeting, Supreme Society, A.E.S., New England Regional Council, Host, Statler Hotel, Hartford, Conn.

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Better Finishes & Coatings, Inc. 86
268 Doremus Ave., Newark 5, N. J.

Brucar Equipment & Supply Co. 121
2740 Grand Ave., Bellmore, L. I., N. Y.

Buckingham Products Co., The
14100 Fullerton Ave., Detroit 27, Mich.

Carbic-Hoechst Corp. 34
Mountainside, N. J.

Ceilcote Co., The
4844 Ridge Rd., Cleveland 9, Ohio

Chemical Corp., The 102
58 Waltham Ave., Springfield 9, Mass.

Chemical Mfg. Co., Inc. 34
444 Madison Ave., New York 22, N. Y.

Churchill Co., Inc., Geo. R.
Hingham, Mass.

Clair Mfg. Co., Inc. 105
1002 So. Union St., Olean, N. Y.

Cleveland Process Co. 97
1965 E. 57th St., Cleveland 3, Ohio

Clinton Supply Co. 121
110 S. Clinton St., Chicago 6, Ill.

Cohn Mfg. Co., Inc., Sigmund 101
121 S. Columbus Ave., Mt. Vernon, N. Y.

Colonial Alloys Co. 94
Ridge Ave. & Crawford St., Philadelphia 29, Pa.

Columbia-Southern Chemical Corp.
One Gateway Center, Pittsburgh 22, Pa.

Conversion Chemical Corp.
100 E. Main St., Rockville, Conn.

Crown Rheostat & Supply Co. 19
1965 Pratt Blvd., Elk Grove Village, Ill.

Davies Supply & Mfg. Co. 108
4160 Meramec St., St. Louis 16, Mo.

Davis-K Products Co. 96
135 W. 29th St., New York 1, N. Y.

Decorative Engineering & Supply, Inc.
17000 S. Western Ave., Los Angeles, Calif.

Deering, Milliken & Co., Inc.
1045 Sixth Ave., New York 18, N. Y.

Detrex Chemical Industries, Inc. 29
Box 501, Detroit 32, Mich.

DeVilbiss Co., The
Toledo, Ohio

Diversey Corp., The 27
1820 Roscoe St., Chicago 13, Ill.

Dixon & Rippel, Inc. 117
Box 116, Saugerties, N. Y.

Dow Chemical Co., The
Midland, Mich.

Dow Chemical Co., The (Saran Lined Pipe)
2415 Burdette Ave., Ferndale 20, Mich.

DuBois Chemicals, Inc. 105, 115
Broadway at Seventh, Cincinnati 2, Ohio

Du Pont de Nemours & Co., E. I. 40, 41
Wilmington 98, Del.

Dytex Chemical Co.
140 India St., Providence 3, R. I.

Electro-Glo Co. 107
621 S. Kolmar Ave., Chicago 24, Ill.

Enthone, Inc. 3
442 Elm St., New Haven 11, Conn.

Fairmont Aluminum Co., Sub. of Cerro de Pasco Corp. 18
Fairmont, W. Va.

Federated Metals Div., American Smelting & Refining Co. 21
120 Broadway, New York 5, N. Y.

Formax Mfg. Co. 106
3171 Bellevue, Detroit 7, Mich.

Frank, Paul 118
118 E. 28th St., New York 16, N. Y.

G. S. Equipment Co.
15583 Brookpark Rd., Cleveland 35, Ohio

Garfield Buff Co.
62 Clinton Rd., Caldwell, N. J.

General American Transportation Corp.
135 S. LaSalle St., Chicago 3, Ill.

Grav-i-Flo Corp. 28
400 Norwood Ave., Sturgis, Mich.

Graver Water Conditioning Co.
216 W. 14th St., New York 11, N. Y.

Gumm Chemical Co., Inc., Frederick 12
538-542 Forest St., Kearny, N. J.

Hamilton Emery & Corundum Co. 119
Chester, Mass.

Hammond Machinery Builders, Inc. 87
1600 Douglas Ave., Kalamazoo 54, Mich.

Hammond Solvents Recovery Service
241 Brunswick St., Hammond, Ind.

Handy & Harman 88
82 Fulton St., New York 38, N. Y.

Hanson-Van Winkle-Munning Co. 10, 11, 44
Matawan, N. J.

Hardwood Line Mfg. Co. 118
2022 N. California Ave., Chicago 47, Ill.

Harshaw Chemical Co., The 6
1945 E. 97th St., Cleveland 6, Ohio

Heatbath Corp. 32
Springfield 1, Mass.

Heil Process Equipment Corp. 85
12914 Elmwood Ave., Cleveland 11, Ohio

Holland & Sons, Inc., J. 111
478 Keap St., Brooklyn 11, N. Y.

Hooker Chemical Corp. 13
1310 Union St., Niagara Falls, N. Y.

Hull & Co., Inc., R. O. 33
1300 Parsons Ct., Rocky River 16, Ohio

Ideal Chemical Co. 121
1499 Dean Dr., So. Euclid 21, Ohio

Illinois Water Treatment Co.
840 Cedar St., Rockford, Ill.

Imperial Industries, Inc. 104
4436 Walker Ave., Wayne, Mich.

Indust Plastics Div., Industrial Sheet Metal Works 100
4025 Bergen Turnpike, N. Bergen, N. J.

Industrial Filter & Pump Mfg. Co. 8
5906 Ogden Ave., Cicero 50, Ill.

Infilco, Inc.
P. O. Box 5033, Tucson, Ariz.

International Nickel Co., Inc. 16
67 Wall St., New York 5, N. Y.

Jelco Finishing Equipment Corp. 30
153 E. 26th St., New York 10, N. Y.

Kelite Corp.
81 Industrial Rd., Berkeley Heights, N. J.

Kinney Vacuum Div., The New York Air Brake Co.
3532 Washington St., Boston 30, Mass.

Koch Sons, Inc., George 111
10 S. 11th Ave., Evansville, Ind.

Kocour Company 38
4802 S. St. Louis Ave., Chicago 32, Ill.

Kosmos Electro-Finishing Research, Inc.
140 Liberty St., Hackensack, N. J.

Kushner, Dr. Joseph B. 119
621 S. Norman, Evansville 14, Ind.

Lasalco, Inc. 17
2820-38 LaSalle St., St. Louis 4, Mo.

Lea Mfg. Co. 35
16 Cherry Ave., Waterbury 20, Conn.

Lea-Michigan, Inc. 109
14459 Wildemere, Detroit 38, Mich.

Lea-Ronal, Inc. 36
139-20 109th Ave., Jamaica 35, N. Y.

L'Hommedieu & Sons Co., Chas. F. 5
4521 Ogden Ave., Chicago 23, Ill.

Lindale Equipment & Supply Corp. 120
504 Smith St., Brooklyn 31, N. Y.

Lindberg Products
P. O. Box 908, Lakeport, Calif.

Macarr, Inc.
4360 Bullard Ave., Bronx 66, N. Y.

MacDermid, Inc. Back Cover
Waterbury 20, Conn.

Magnus Chemical Co., Inc. 99
11 South Ave., Garwood, N. J.

Manhattan Rubber Div., Raybestos-Manhattan, Inc. 30
6 Willett St., Passaic, N. J.

Meaker Co., The
Sub. of Sel-Rex Corp., Nutley 10, N. J.

Mearl Corp., The
41 E. 42nd St., New York 17, N. Y.

Metal & Thermit Corp. 42
Rahway, N. J.

Michigan Buff Co., Inc. 122
3503 Gaylord Ave., Detroit 12, Mich.

Michigan Chrome and Chemical Co.
8615 Grinnell Ave., Detroit 13, Mich.

Motor Repair & Mfg. Co., The 122
1555 Hamilton Ave., Cleveland 14, Ohio

Munning & Munning, Inc.
202-208 Emmett St., Newark 5, N. J.

Murray-Way Corp. 98
P. O. Box 180, Maple Rd. E., Birmingham, Mich.

Neilson Chemical Co.
2300 Gainsboro, Ferndale 20, Mich.

New York Air Brake Co., Kinney Vacuum Div.
3532 Washington St., Boston 30, Mass.

Northwest Chemical Co. 15
9310 Roselawn Ave., Detroit 4, Mich.

Oakite Products, Inc. 4
18 Rector St., New York 6, N. Y.

Packer Machine Co. 95
456 Center St., Meriden, Conn.

Pesco Plating Equipment Corp. 122
75 Wythe Ave., Brooklyn 11, N. Y.

Pfizer & Co., Inc., Chas. 20
630 Flushing Ave., Brooklyn 6, N. Y.

Phelps Dodge Refining Corp. 92
300 Park Ave., New York 22, N. Y.

Plating Products, Inc. 112
1509 N. Washington, Kokomo, Ind.

Plating Service & Equipment Corp. 120
3620 Hart St., Detroit 14, Mich.

Randolph Products Co. 117
92 North 12th St., Carlstadt, N. J.

Ransburg Electro-Coating Corp. 84
3939 W. 56th St., Indianapolis 23, Ind.

Rapid Electric Co. Inside Front Cover
2881 Middletown Rd., Bronx 61, N. Y.

Raybestos-Manhattan, Inc. Manhattan Rubber Div. 30
Passaic, N. J.

Reliable Industrial Equipment Co. 121
633 Richmond St., Grand Rapids 4, Mich.

Robertshaw-Fulton Controls Co., Fulton Sylphon Div.
Knoxville 1, Tenn.

Rona Pearl Corp., Div. Rona Laboratories, Inc. 116
E. 21st & E. 22nd Sts., Bayonne 3, N. J.

Sandoz, Inc. 39
61 Van Dam St., New York 13, N. Y.

Schaffner Mfg. Co., Inc. 26
22 Herron Ave., Emsworth, Pittsburgh 2, Pa.

Sel-Rex Corp. Inside Back Cover
75 River Rd., Nutley 10, N. J.

Servi-Sure Mfg. Co. 110
131 N. Green St., Chicago 7, Ill.

Sethco Mfg. Co. 103
2286 Babylon Turnpike, Merrick, L. I., N. Y.

Sommers Bros. Mfg. Co. 119
3439 No. Broadway, St. Louis 7, Mo.

Sparkler Mfg. Co.
Conroe, Texas

Stevens, Inc., Frederic B. 22, 23, 102
1808 - 18th St., Detroit 16, Mich.

Stutz Co., The 114
4430 W. Carroll Ave., Chicago 24, Ill.

Surety Rubber Co.
Carrollton, Ohio

Technic, Inc. 43
88 Spectacle St., Cranston, R. I.

Trerice Co., H. O. 109
1420 W. Lafayette Blvd., Detroit 16, Mich.

True Brite Chemical Products Co. 106
P. O. Box 31, Oakville, Conn.

Tumb-L-Matic, Inc. 108
St. Mary's St., Stamford, Conn.

Turco Products, Inc.
24600 So. Main, Wilmington, Calif.

Udylite Corp., The 89, 90, 91, 93
Detroit 11, Mich.

Unit Process Assemblies, Inc. 26
53-15 37th Ave., Woodside 77, N. Y.

U. S. Stoneware 31
Akron 9, Ohio

Unitron Instrument Co., Microscope Sales Div. 103
66 Needham St., Newton Highlands 61, Mass.

Univertical Corp.
14841 Meyers Rd., Detroit 27, Mich.

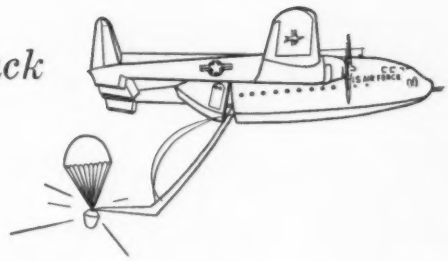
Vycote Co. 110
P. O. Box 6893, Journal Sq. Sta., Jersey City, N. J.

Worthy Products Co. 121
Box 1432, Boca Raton, Fla.

Wyandotte Chemicals Corp. 83
Wyandotte, Mich.

Zialite Corp.
92 Grove St., Worcester 5, Mass.

finding the golden needle in the haystack





(Top right) *sketch illustrates mid-air catch of returning Discoverer XIV nose cone snagged by an airplane-towed "skyhook."* (left) *A captured practice capsule is slowly reeled towards the rear opening of airborne C-119 Recovery Plane.*

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Orbiting the globe, then returning earthward upon signal, Discoverer XIV's space capsule plummeted home to be snatched from the heavens in an historic mid-air catch!

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(Above) *President Eisenhower holds American flag which was in recovered capsule during its flight through space. Capsule shown was electroplated with patented Sel-Rex Bright Gold Process. With the President are General Thomas D. White, Air Force chief* (center) *and Col. Charles G. Mathison, who directed the "capsule chase."*

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1

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2

MACroBrite C-9

A single-dip acid salt used with water to produce a clear, bright chromate finish on cadmium.

3

MACroBrite L-6

An acid salt for clear, bright leach-type chromate, or iridescent bronze coatings on zinc or cadmium.



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